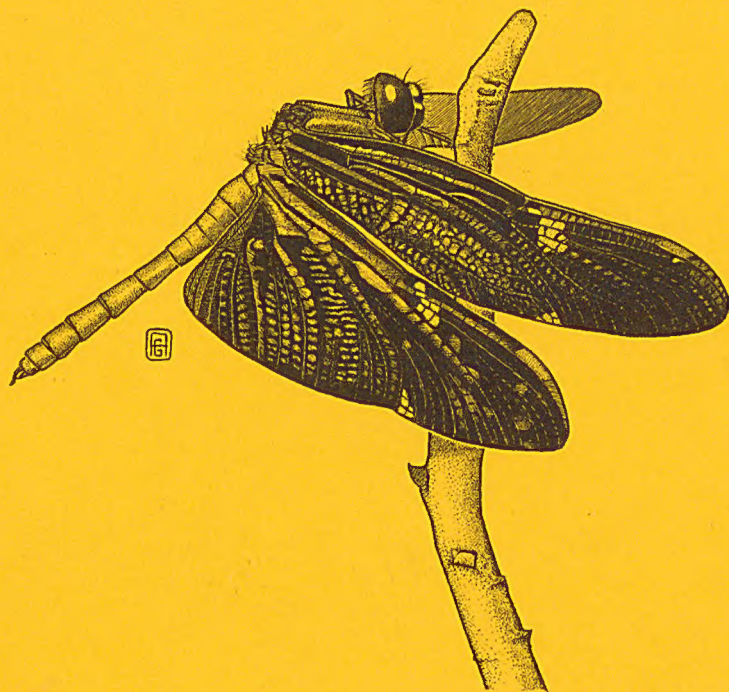


# THE AUSTRALIAN Entomologist

*published by*  
THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND



**Volume 41, Part 4, 1 December 2014**

**Price: \$8.00 per part**

ISSN 1320 6133



## THE AUSTRALIAN ENTOMOLOGIST

ABN#: 15 875 103 670

The Australian Entomologist is a non-profit journal published in four parts annually by the Entomological Society of Queensland and is devoted to entomology of the Australian Region, including New Zealand, Papua New Guinea and islands of the south-western Pacific. Articles are accepted from amateur and professional entomologists. The journal is produced independently and subscription to the journal is not included with membership of the society.

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**Cover:** A basking male of *Rhyothemis princeps princeps* Kirby 1894 (Odonata: Libellulidae) at Eubenangee Swamp, North Queensland. This subspecies occurs in tropical Queensland from Rockhampton north to Iron Range and Weipa and is also known from southern New Guinea. It is very common at most standing waters in the Queensland Wet Tropics where it occurs together with its congeners *Rhyothemis graphiptera* Rambur, 1842 and the rarer *Rhyothemis resplendens* Selys, 1878. Another race with much more extensive hyaline areas occurs in north and east New Guinea. Pen and ink drawing by Dr Albert Orr whose illustrated books on dragonflies and butterflies have won awards in Australia and overseas. He lived at Bramston Beach 1999-2004 and nearby Eubenangee Swamp was a favourite hunting ground.

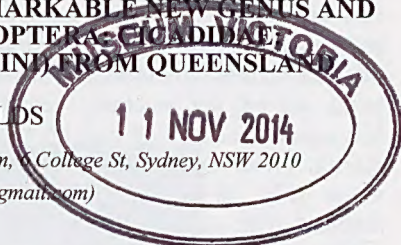


**EUTHEMOPSALTRIA LAETA, A REMARKABLE NEW GENUS AND SPECIES OF CICADA (HOMOPTERA: CICADETTINAE: CHLOROCYSTINI), FROM QUEENSLAND**

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**Abstract**

*Euthemopsaltria laeta* gen. n. et sp. n. is a species with unusual forewing venation showing extreme branching of the median vein that results in many very long parallel veins meeting the ambient vein. In other regards it is typical of the Chlorocystini, with a large inflated male abdomen, a narrow head and leaf-green colouration. Its relationships to other Chlorocystini are discussed and a key to the Australian species of Chlorocystini is provided.

**Introduction**

The Chlorocystini are a distinctive tribe of mostly green cicadas with narrow heads, the males of which have inflated abdomens and an 'S'-shaped theca (de Boer 1995, Moulds 2012a). In Australia there are currently 14 described species in 9 genera (de Boer 1997, Moulds 2012a, 2012b). The discovery of a rather large and distinctive new species of Chlorocystini in northern Queensland rainforests that showed unusual forewing venation, with extreme branching of the median veins creating many very long parallel veins, was unexpected. This unusual species also represents a new genus and both are described below.

De Boer (1997) provided a key to males of the Australian Chlorocystini. Below I provide an alternative key that incorporates females and the new genus and species described in this paper. Phylogenetic relationships of the new genus and species are also discussed.

Terminology for morphological features and higher classification follows that of Moulds (2005).

**Genus *Euthemopsaltria* gen. n.**

(Figs 1-12)

Type species: *Euthemopsaltria laeta* sp. n., by present designation.

**Diagnosis.** Green cicadas of medium size (Figs 1-2). *Head* including eyes narrow, considerably less than mesonotum; supra-antennal plate meeting or nearly meeting eye; postclypeus angulate in transverse cross-section, in lateral profile angulate between 'top' and 'sides'. *Thorax.* Pronotal collar width at dorsal midline narrow, much less than diameter of eyes; paranota confluent with adjoining pronotal sclerites, no mid lateral tooth. Cruciform elevation wider than long. Epimeral lobe not reaching operculum. Metanotum partly visible at dorsal midline. *Forewings* (Fig. 4) hyaline with distinct green suffusion; some 20-30 apical cells; a series of approximately 20 subapical cells; ulnar cell 3 substantially parallel to radial cell; basal cell long and



narrow; costal vein (C) clearly higher than R+Sc; costa broadest a little before node; pterostigma absent; vein CuA nearly straight, weakly bowed so that cubital cell no wider than medial cell; veins M and CuA close together at basal cell but not touching; vein CuA<sub>1</sub> divided by crossvein m-cu more or less equally; veins CuP and 1A fused in part; infuscations absent; wing outer margin greatly reduced and virtually contiguous with ambient vein. *Hind wings* (Fig. 5) with approximately 9-11 apical cells; no infuscation on ambient vein; width of 1st cubital cell at distal end at least twice that of 2nd cubital cell; anal lobe broad with vein 3A curved, long, separated from wing margin; veins RP and M fused basally. *Foreleg* femoral primary spine cylindrical, tending towards lying flat but not quite so. *Male opercula* clearly not meeting, distant from lateral margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, clearly raised above level of tympanal cavity on its outer half; inner margin straight; apically tapering to a blunt point. *Male abdomen* (Fig. 3) markedly inflated, substantially hollow, obtuse; male tergites in cross-section with sides concave, lateroventrally rounded to ventral surface; male tergites 2 and 3 similar in size to tergites 4-7; male sternites 3-7 in cross-section convex. Timbal covers absent. Timbal ribs (Fig. 6) many (approximately 11-13), regular in size and closely spaced filling entire timbal area apart from basal dome; timbals extended below wing bases.

*Male genitalia* (Figs 7-10). Pygofer with distal shoulder not developed; upper lobe and basal lobe ill-defined, substantially confluent with pygofer margin; dorsal beak present and a part of chitinized pygofer. Uncus undeveloped, globular. Claspers large, dominant, claw-like, restraining aedeagus. Aedeagus with basal plate in lateral view undulated, weakly depressed on dorsal midline; in dorsal view short, tending rounded, apically indented; basal portion of basal plate directed forwards away from thecal shaft; ventral rib completely fused with basal plate; junction between theca and basal plate rigid, without a 'hinge'; thecal shaft barely 'S'-shaped; pseudoparameres absent; thecal apex entirely chitinised, thecal subapical cerci absent; legula absent; conjunctival claws absent; vesica retractable, vesical opening apical on theca. *Male reproductive system* unknown.

*Female reproductive system* ditrysian; length of accessory glands unknown.

*Distinguishing features.* Readily distinguished by the forewing venation, which has from 20 to 30 long apical cells and about 15 to 20 subapical cells; also the forewing usually carries a distinct green suffusion, evenly distributed. The hind wing has approximately 9 apical cells. Like many other Chlorocystini the male abdomen is markedly inflated. The head is narrow and considerably less than the width of the mesonotum. The aedeagus lacks appendages.

*Included species.* *Euthemopsaltria laeta* sp. n. The genus is monotypic.



*Etymology.* From the Greek *euthemon*, meaning well-arranged or neat and referring to the neatly arranged parallel forewing veins, and from *psaltria*, a traditional ending for cicada generic names probably originating from the Latin meaning a female harpist. Feminine.



**Figs 1-2.** *Euthemopsaltria laeta* sp. n.: (1) live male, lateral view; (2) live female, lateral view. Photos Stan and Kaisa Breeden.



*Euthemopsaltria laeta* sp. n.

(Figs 1-12)

*Types.* *Holotype* ♂, QUEENSLAND: Windsor Tableland, NNW of Mossman, 20.ii.1982, M.S. & B.J. Moulds (in Australian Museum, Sydney). *Paratypes*: 1 ♂, Kuranda, 25.ix.1981, W.N.B. Quick (in Australian National Insect Collection, Canberra); 3 ♂♂, 9 km along Merragallan Rd, WSW of Malanda, 12.v.2003, 23.vi.2003, 21.ii.2004, J. Olive (in collection of J. Olive, Cairns); 1 ♂, near Millaa Millaa, 17.564°S, 145.579°E, 25.iv.2014, B. Hacobian; 1 ♀, Malanda district, v.1998, S. Breeden; 1 ♂, same data as holotype but 16.i.1988; 1 ♀, Windsor Tableland, 5.iii.1992, J. Hasenpusch; 1 ♂, Mt Lewis, iv.1987, J. Mallet; 1 ♀, Kuranda, i.1993, S. Lamond; 1 ♀, Kuranda, 11.iv.1981, G. Wood (in collection of M. Moulds, Kuranda); 1 ♂, Kirrama Range, Douglas Ck Rd, 800 m, 9-12.xii.1986, Monteith, Thompson & Hamlet (in Queensland Museum, Brisbane); 1 ♂, Kuranda, F.P. Dodd (in South Australian Museum, Adelaide).

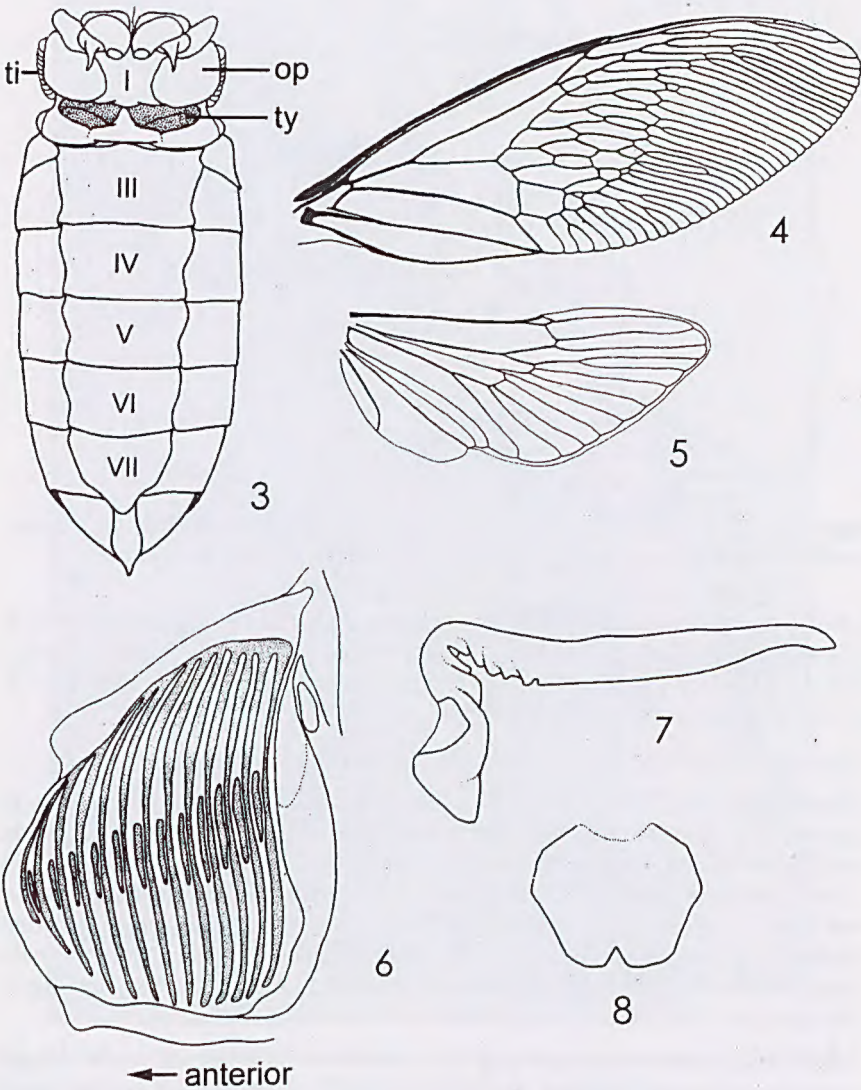
*Other material examined.* 1 ♂, Mt Glorious State Forest, southeastern Queensland, 25.xii-2.i.87, from *Argyrodendron actinophyllum* [intercept flight trap] by Y. Basset (in author's collection). This specimen is indistinguishable from those of the type series but in view of its locality being so distant from other known localities it might represent another species.

*Description. Male.* Head, thorax and abdomen primarily uniformly leaf green although a little paler below; underside partly pale pinkish, mainly at base of abdomen and bases of legs. Head with supra-antennal plates and anterior rim of postclypeus brown, tending paler on supra-antennal plates. Eyes of live specimens pale to light brown. Antennal plates and anterior margin of postclypeus brown, glossy. Rostrum reaching to apices of mid coxae. Timbals (Fig. 6) tending whitish with short ribs light brown; with 11-12 long parallel ribs. Forewings uniformly and strongly tinted green; basal membrane pale orange; venation as in Fig. 4 but individually variable in the vicinity of subapical cells and to a small degree in the apical cells; venation green in live specimens except for much of vein 2A+3A, which is brown. Hind wings very weakly tinted green; venation as in Fig. 5 but with some individual variation in the division of apical cells; venation very pale green. Legs green with fore tibiae brown, the joint between tibia and femur on mid and hind legs brown, all tarsi brown or mostly so, all pretarsal claws black on their distal half.

Genitalia (Figs 7-10) with uncal lobes robust, broad in ventral view, claw-like in lateral view. Aedeagus (Figs 7-8) with theca simple and tubular, gradually tapering to apex, basally turned through 180°, convolute on inner surface; basal plate in dorsal view tending to be rounded, indented at apical midline in a V-shape.

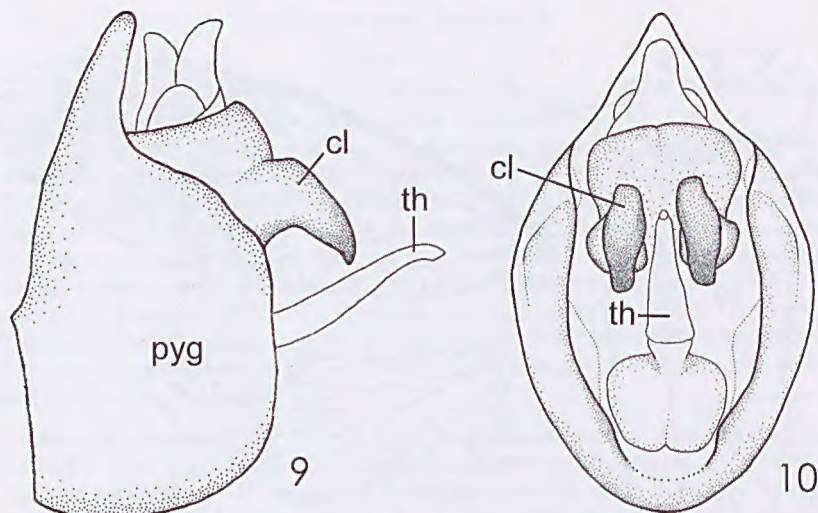
*Female.* Similar to male. Abdominal segment 9 stocky, dorsal midline clearly less than twice the length of that of tergite 8; apical spine small, blunt; ovipositor sheath not longer than abdominal segment 9.

*Distinguishing features.* See generic description above.



**Figs 3-8.** *Euthemopsaltria laeta* sp. n., male: (3) abdomen, ventral view; (4) forewing; (5) hind wing; (6) timbal; (7) aedeagus, lateral view; (8) basal plate, dorsal view, apex at bottom. *op* operculum; *ti* timbal; *ty* tympanum; *I-VII* numbered sternites.





**Figs 9-10.** *Euthemopsaltria laeta* sp. n., male genitalia: (9) lateral view; (10) ventral view with claspers spread apart. *cl* clasper; *pyg* pygofer; *th* theca of aedeagus.

*Measurements* (mm).  $n = 7$  males, 4 females. *Length of body*: male 32.6-34.8 (33.93); female 22.8-23.7 (23.25). *Length of forewing*: male 33.8-35.7 (34.6); female 30.0-35.9 (32.95). *Width of head*: male 5.2-5.6 (5.43); female 5.3-5.6 (5.45). *Width of pronotum*: male 7.8-8.2 (8.03); female 7.1-8.5 (7.8).

*Etymology.* From the Latin *laetus* meaning joyful, glad, pleasant.

*Distribution and habitat* (Fig. 11). Northeastern Queensland, where it is known only from the Windsor Tableland, Mount Lewis, Kuranda, Malanda and Millaa Millaa districts and the Kirrama Range. Adults have been taken in all months from December to June and at Malanda can be found throughout the year (J. Olive pers. comm.). It is a locally common species around Malanda, Millaa Millaa and on the Windsor Tableland. A single known male from Mount Glorious State Forest in southeastern Queensland may belong to this species.

Adults usually perch amongst tangled vegetation a little beyond reach and are normally difficult to capture but occasionally they occur near ground level where they are easily taken by hand. The species is found only in primary rainforest where it tends to be locally common.

*Song.* Males sing at dusk when it is almost dark and continue for some 15-20 minutes. The call is loud, resembles a constant, high-pitched whistle and most likely is a pure tone (*i.e.* resonates at a precise frequency); no recordings are available.



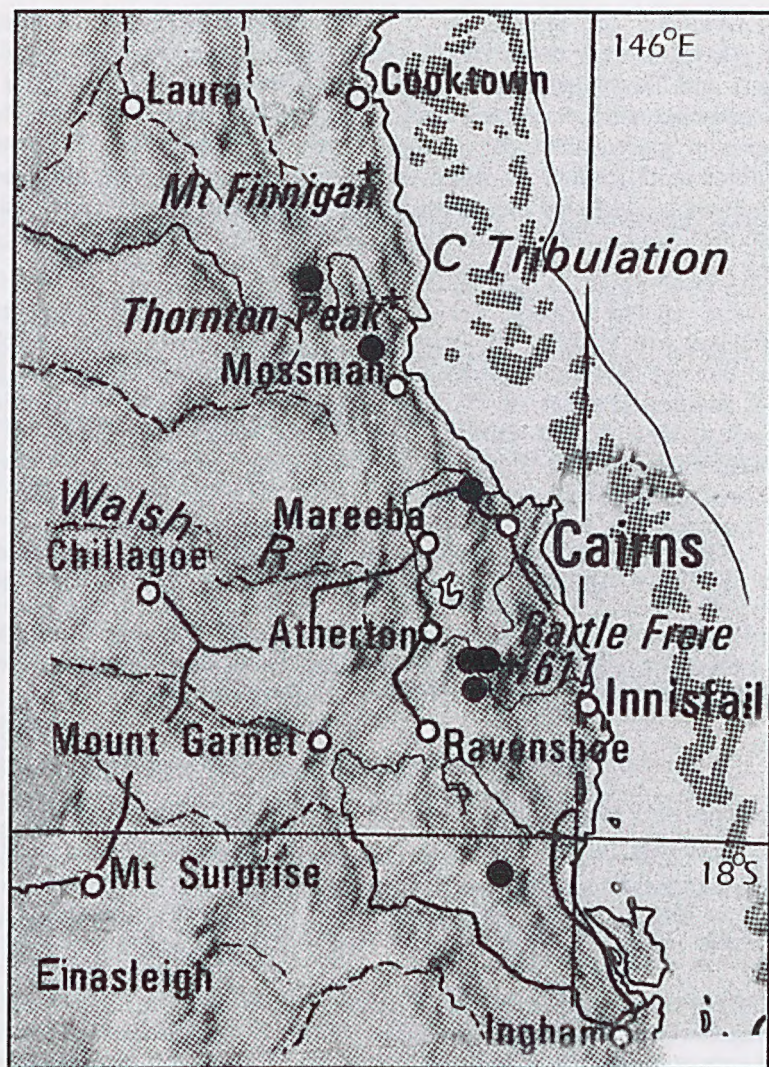


Fig. 11. Map of northeastern Queensland centred around Cairns, showing distribution of *Euthemopsaltria laeta* sp. n.; black dots indicate known localities.

### Phylogenetic relationships

To determine the phylogenetic relationships of *Euthemopsaltria laeta* a cladistic analysis was undertaken, using the species of Chlorocystini and relevant characters extracted from the cladistic analysis of Moulds (2005). The species included are the type species of relevant genera [except for *Thaumastopsaltria adipata* (Stål) and *Lembeja maculosa* (Distant), which



were unavailable and replaced by *T. globosa* (Distant) and *L. vitticollis* (Ashton) respectively], to which have been added *Gymnotympana varicolor* (Distant) and *Thaumastopsaltria smithersi* Moulds because they differ in some character states from their congeners. The character descriptions and the matrix of species and their assigned states are given in Table 1, together with minor modifications as stated in the notes below relevant characters. Outgroup choice included those representatives of three genera identified as sister to the Chlorocystini by Moulds, viz. *Lembeja vitticollis*, *Prasia faticina* Stål and *Parnisa designata* (Walker).

Data were analysed using the heuristic search parsimony algorithms implemented with PAUP\* version 4.0d100 (Swofford 2003). Tree searches utilised the tree bisection reconnection algorithm (TBR) conducting 1,000 random addition searches (RAS) starting from random trees; other settings were left at their default values. All characters were unweighted and all multistate characters were treated as unordered. Unknown or irrelevant character states have been scored as '?'.

**Table 1.** Character matrix used in the parsimony analysis (based on that used in Moulds 2005) for Australian Chlorocystini. Missing data and character states unknown are scored as '?'. In the list of character descriptions, character numbers in brackets are those that correspond to those in Moulds (2005) in his larger analysis of cicada relationships. Some character states used by Moulds (2005) were irrelevant to this analysis and states have been renumbered sequentially from zero.

Species	1	11111	11112	2
	12345	67890	12345	67890
<i>Lembeja vitticollis</i> (Ashton, 1912)	00?00	00000	00000	0000? ?
<i>Prasia faticina</i> Stål, 1863	00?00	?0000	10000	0?0?? ?
<i>Parnisa designata</i> (Walker, 1858)	10?01	10101	00010	00??? ?
<i>Chlorocysta vitripennis</i> (Westwood, 1851)	31111	11111	00111	11111 1
<i>Cystopsaltria immaculata</i> Goding & Froggatt, 1904	6???0	?000? 01011	0111?	? ?
<i>Cystosoma saundersii</i> Westwood, 1842	6???0	?000? 01011	01111	0
<i>Euthemopsaltria laeta</i> sp. n.	5131?	11012	02111	1121? ?
<i>Glaucopepsaltria viridis</i> Goding & Froggatt, 1904	41111	11110	00111	1121? ?
<i>Guineapepsaltria flava</i> (Goding & Froggatt, 1904)	00?01	11100	00111	01110 ?
<i>Gymnotympana strepitans</i> (Stål, 1861)	00?01	11100	10211	0111? ?
<i>Gymnotympana varicolor</i> (Distant, 1907)	00?01	11100	10111	0111? ?
<i>Owra insignis</i> Ashton, 1912	21011	11001	00?11	0111? ?
<i>Thaumastopsaltria globosa</i> (Distant, 1897)	30?10	10000	01111	0111? ?
<i>Thaumastopsaltria smithersi</i> Moulds, 2012	30?10	10100	00111	0111? ?
<i>Venustria superba</i> Goding & Froggatt, 1904	10?01	11100	00001	0??1? ?



### *Characters and character states*

1(15). *Forewing apical cell number*: (0) 8 cells; (1) 9 cells; (2) 10 cells; (3) 12 cells; (4) 13 cells; (5) 20 to more than 30 cells; (6) multiple reticulation.

Note: Abnormalities in wing venation are common occurrences. Such abnormalities have been ignored when scoring character states.

2(16). *Forewing subapical cells*: (0) absent; (1) present.

3(17). *Forewing subapical cell number*: (0) 4 cells; (1) approximately 6 cells; (2) approximately 20 cells.

4(18). *Forewing ulnar cell 3*: (0) angled to radial cell; (1) substantially parallel to radial cell.

5(19). *Forewing costa*: (0) reducing or parallel-sided to node; (1) broadest a little before node; (2) with a swollen 'nodule' preceding node.

6(20). *Forewing pterostigma*: (0) present; (1) absent.

7(23). *Forewing vein RA*: (0) aligned closely with subcosta (Sc) for its length; (1) diverging from subcosta (Sc) in subapical region.

8(27). *Forewing outer margin*: (0) greatly reduced and in part contiguous with ambient vein; (1) developed for its total length.

9(29). *Forewing membrane when hyaline*: (0) lacking green tint; (1) with green tint.

10(30). *Hind wing apical cell number*: (0) 6 cells; (1) 4 or 5 cells; (2) 7-10 cells.

11(33). *Hind wing anal lobe*: (0) broad with vein 3A usually strongly curved at distal end, long and separated from wing margin; (1) narrow with vein 3A tending straight, short and usually adjacent to wing margin.

12(35). *Foreleg femoral primary spine*: (0) erect; (1) lying flat, prostrate.

13(38). *Male opercula development*: (0) more or less reaching margin of tympanal cavity (rarely beyond), directed towards distomedial margin of tympanal cavity, apically broadly rounded, not meeting; (1) distant from lateral margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically tapering to a blunt point, inner margin straight, clearly not meeting; (2) nearly triangular, strongly cupped, covering and extending beyond tympanal cavity, completely encapsulating meracanthus, not meeting.

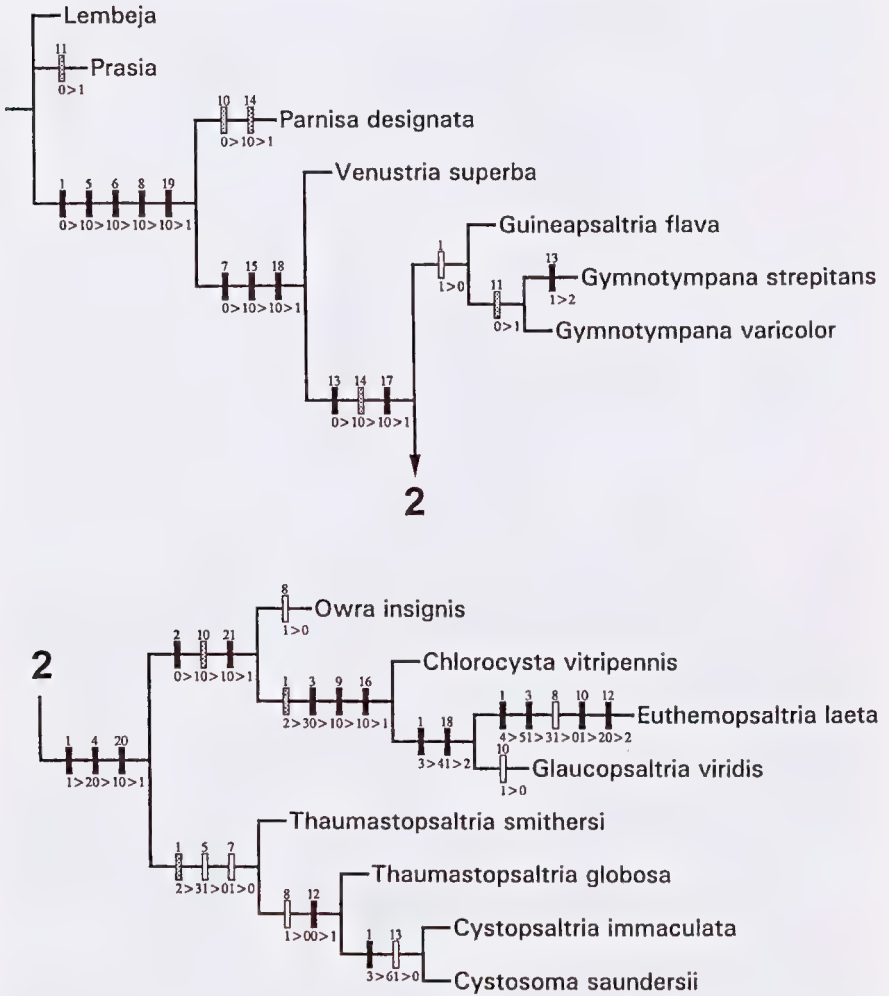
Note: The apparent continuity of operculum development makes scoring difficult. Discrete groupings in length and breadth are for the most part lacking and distal and median development appear to be interrelated. For these reasons scoring of the opercula has been limited to identifying groupings exhibiting similar overall shape and size.

14(39). *Male tergites in cross-section*: (0) sides straight or convex; (1) sides partly concave.

15(40). *Male tergites lateroventrally*: (0) epipleurites reflexed to ventral surface; (1) epipleurites rounded to ventral surface.

16(48). *Timbal ribs*: (0) up to seven long ribs; (1) many ribs, at least eight or more.

Note: The character states given here are a refinement upon those given for this character in Moulds (2005) to encompass the diversity within the Chlorocystini.



**Fig. 12.** One of two equally parsimonious trees from a cladistic analysis derived using the procedure described in the text above (length 42, CI 73, RI 78) from an analysis employing *Lembeja vitticollis* as outgroup, with all characters unordered and equally weighted. Numbers at nodes are bootstrap values greater than 50% from 1,000 replications. Character transformations are shown at each node: black bars = non-homoplasious forward change; grey bars = homoplasious forward change; white bars = reversal (whether homoplasious or not).



17(56). *Pygofer upper lobe when thickened*: (0) well developed; (1) small, bud-like, accentuated by adjacent 'dimple' in pygofer.

18(68). *Aedeagal basal plate in dorsal view*: (0) apically broadened with 'ears'; (1) short, broad, usually rounded; (2) short, broad, rounded but apically indented.

Note: State 2 has been added to encompass the diversity within the Chlorocystini not relevant in Moulds (2005). *Parnisa designata* and *Venustria superba* have been scored as '?' because they are unique and unlike any of the other species.

19(73). *Theca in lateral view*: (0) straight or curved in a gentle arc; (1) 'S' shaped or tending so.

20(85). *Accessory glands*: (0) short; (1) long.

21(86). *Accessory glands of common oviduct*: (0) short; (1) long.

## Results

Results produced two equally parsimonious trees (length 42, CI 73, RI 78) that differed only in the arrangement of *Guineapsaltria* de Boer and *Gymnotympana* Stål. This small difference had no effect on the placement of *Euthemopsaltria laeta* sp. n., which fell within a well-supported clade together with *Chlorocysta* Westwood, *Glaucopsaltria* Goding & Froggatt and *Owra* Ashton in both trees (see Fig. 12). The grouping of these three genera was also identified by de Boer (1995) in his study of the Chlorocystini using similar characters but different character states. *Euthemopsaltria* gen. n., *Chlorocysta*, *Glaucopsaltria* and *Owra* are unique among the Chlorocystini in having a continuous row of subapical cells in the forewing. Relationships between these four genera place *Owra* as sister to *Chlorocysta*, *Glaucopsaltria* and *Euthemopsaltria*, which share a translucent green tint to the forewing, another attribute unique within the Chlorocystini, and moderately developed male opercula as distinct from the rudimentary opercula of *Owra*. *Euthemopsaltria* is placed sister to *Glaucopsaltria* and supported by two synapomorphies: many apical cells (20 to more than 30) and a short, broad, rounded basal plate that is apically indented.

Other genera of Chlorocystini not represented in Australia and not included in the analysis of Moulds (2005), viz. *Aedeastria* de Boer, *Baeturia* Stål, *Mirabilopsaltria* de Boer, *Papuapsaltria* de Boer and *Scottotympana* de Boer, clearly fall outside the clade comprising *Chlorocysta*, *Glaucopsaltria* and *Owra* (de Boer 1995) and consequently are not considered closely related to *Euthemopsaltria*.

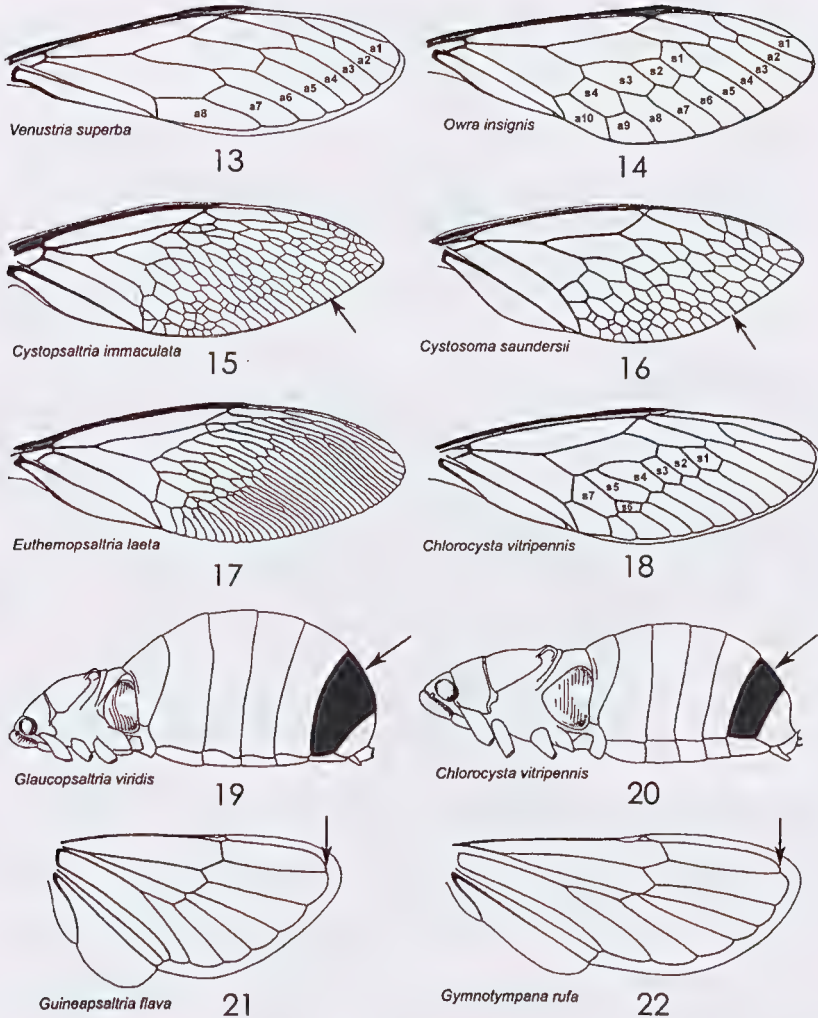
## Key to described species of Australian Chlorocystini

A number of features used in this key are not clearly visible to the naked eye and examination of specimens at magnification is recommended. Specimens are best viewed with the wings spread and, when there is a choice between sexes, it is usually best to use a male.

1 Forewing with 8 apical cells (Fig. 13) ..... 12

- Forewing with 9 or more apical cells (Figs 14-18) (if one wing has 8 and the other 9, then treat as having 8, not 9) . . . . . 2
- 2 Forewing hyaline or translucent green . . . . . 5
- Forewing entirely opaque and coloured green, orange or turquoise . . . . 3
- 3 Forewing with majority of marginal cells long and slender, at least three times longer than wide (Fig. 15) . . . . . *Cystopsaltria immaculata*
- Forewing with only a few marginal cells reaching three times longer than wide, majority much less (Fig. 16) . . . . . 4
- 4 Forewing 36-54 mm; costa of forewing strongly ampliate near base so that width of ampliate section is about twice that of more distal part . . . . . *Cystosoma saundersii*
- Forewing 26-36 mm; costa of forewing weakly ampliate near base so that width of ampliate section is only slightly wider than more distal part . . . . . *Cystosoma schmeltzi*
- 5 Forewing with many apical cells, around 20-30 in number (Fig. 17) . . . . . *Euthemopsaltria laeta* **gen. n., sp. n.**
- Forewing with 9-15 apical cells . . . . . 6
- 6 Forewing with a single row of subapical cells (Fig. 14) . . . . . 7
- Forewing with no subapical cells (Fig. 13) . . . . . 11
- 7 Forewing with 10 apical cells (sometimes 9 or 11 if aberrant, but usually so only in one wing); 4 or 5 subapical cells (Fig. 14) . . . . . *Owra insignis*
- Forewing with 12 or more apical cells (sometimes 11 if aberrant, but usually so only in 1 wing); 6 or more subapical cells (Fig. 18) . . . . . 8
- 8 Male tergite 7 clearly larger than others, its dorsal midline much greater in length (Fig. 19); female normally with 13 apical cells in forewing and 6 apical cells in hind wing (aberrant specimens can have one more or one less in either but usually only in one wing) . . . . . *Glauropsaltria viridis*
- Male tergite 7 similar in size to others (Fig. 20); female normally with 12 apical cells in forewing and 5 apical cells in hind wing (aberrant specimens can have one more or one less in either but usually so only in one wing) . . . . . 9
- 9 Plain green cicadas (often yellowish brown in discoloured collection specimens) without markings; males with 9 long timbal ribs . . . . . *Chlorocysta vitripennis*
- Mottled olive-green cicadas, with dark lateral abdominal markings; males with 11 long timbal ribs . . . . . 10
- 10 Postclypeus with a brown blotch below . . . . . *Chlorocysta suffusa*
- Postclypeus lacking a brown blotch below . . . . . *Chlorocysta fumea*





**Figs 13-22.** Diagrams accompanying Key to species of Australian Chlorocystini: (13-18) forewings; (19-20) lateral profile of body; (21-22) hind wings.

- 11 Forewing hyaline . . . . . *Thaumastopsaltria globosa*
- Forewing translucent green . . . . . *Thaumastopsaltria smithersi*
- 12 Head, thorax and abdomen green (sometimes red), virtually without markings . . . . . 13
- Head, thorax and abdomen never all green (or red) . . . *Venustria superba*
- 13 Forewing costa red . . . . . *Gymnotympana rufa*

- Forewing costa green or yellowish green ..... 14
- 14 Male ..... 15
- Female ..... 16
- 15 Abdomen entirely green, yellow or orange below . . . *Guineapsaltria flava*
- Abdomen partly or entirely red below ..... *Gymnotympana varicolor*
- 16 Hind wing apical cell 1 with its distal end as long as, or almost as long as, apical cell 2 (Fig. 21) ..... *Guineapsaltria flava*
- Hind wing apical cell 1 with its distal end clearly shorter than end of apical cell 2 (Fig. 22) ..... *Gymnotympana varicolor*

### Acknowledgements

I am grateful to Tony Ewart and Lindsay Popple for providing helpful comments on the manuscript. I thank Y. Basset, S. & K. Breeden, B. Hacobian, J. & S. Hasenpusch, J. Mallet, S. Lamond and G. Wood for kindly donating specimens. The line drawings for Figs 3 and 6 were done by Ivan Nozaic, Figs 4 and 5 by Damian Brymora, Figs 7-10 by Kyra Kopestonsky; to all I extend my sincere thanks. Stan and Kaisa Breeden kindly allowed use of their photographs of live adults. Financial assistance for the figures was provided by the National Science Foundation, grant number DEB 09-55849.

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# THE REDISCOVERY OF *CHILASA MOERNERI MAYRHOFERI* (BANG-HAAS, 1939) (LEPIDOPTERA: PAPILIONIDAE) IN NEW BRITAIN, PAPUA NEW GUINEA AND DESCRIPTION OF THE FEMALE

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## Abstract

*Chilasa moerneri mayrhoferi* (Bang-Haas), previously known only from the male holotype collected more than 70 years ago, is recorded from both East and West New Britain Provinces, Papua New Guinea. The female is described and both sexes, including the holotype male, are illustrated for the first time. This taxon is compared with the nominate subspecies from New Ireland.

## Introduction

*Chilasa moerneri* (Aurivillius) is one of a small group of allopatric *Chilasa* Moore species that occur in Indonesian Papua, Papua New Guinea and the Solomon Islands (Hancock 1983, 2009). This species has always intrigued collectors and researchers. Until recently, only a handful of specimens of the nominate race were known and the female had been misidentified as a male. The species was regarded as probably extinct by D'Abrera (1971). The prepupal larva and pupa of the nominate subspecies were described by Müller (2001), who compared them with those of *C. laglazei* (Depuiset) and *C. toboroi* (Ribbe).

*Chilasa moerneri mayrhoferi* (Bang-Haas) was described from a single male (Figs 1-2) collected in the south-east Baining Mountains, East New Britain Province, Papua New Guinea. It is held in the Dresden Museum, Germany. The precise position of the type locality is unknown. Müller (2001) erroneously assumed that the type had been lost.

Otto Bang-Haas (1939a, b) described *C. m. mayrhoferi* (as *Papilio mörneri mayrhoferi*) and *Delias mayrhoferi* Bang-Haas, both without figures, on the eve of the Second World War. The latter name was overlooked and confused with the junior synonym *D. schunichii* Morita, 1996 for several decades (Häuser *et al.* 2009, Müller and Wills 2013).

## Records

A male of *C. m. mayrhoferi* was observed by one of us (CM) in December 2005, in the Whiteman Range, West New Britain, as it flew along a ridge at height. On the northern slopes of the Baining Mountains, East New Britain, during the second week of December 2006, a solitary *C. m. mayrhoferi* was observed and filmed by LW as it flew around the top of an *Albizia* tree (Mimosaceae) at a height of about 35 m. From approximately 1100 to 1400 h,

the adult circled the tree, stopping to take nectar on only three occasions. Due to its exceptionally wide trunk, the tree could not be climbed. At 1100 h the following morning, the specimen returned and began to repeat the circling behaviour observed the previous day. A plan was devised to climb a smaller adjacent tree of about 30 m and build a platform at the top. With a net balanced on top of a 12 m long handle, the specimen could hopefully be reached. After precariously perching on the platform and enduring the scorching heat for almost three hours, the specimen was finally captured. Since 2011, both LW and CM have recorded a limited number of both sexes in the Baining Mountains and the Whiteman Range, respectively. All specimens were collected between 800 and 1100 m.

***Chilasa moeneri mayrhoferi* (Bang-Haas)**

(Figs 1-9)

*Description of female* (Figs 8-9). Head, thorax and legs black, abdomen dark green-black. Antenna short, approximately one-third length of costa, black, elongated clubs. Forewing upperside shining dark green, postmedian area broadly dark blue, apical area dark blue suffused with grey. Forewing underside dark lustrous grey-green, a subterminal band of yellow spots reaching into subapical area as far as space 7, band up to 6 mm wide towards costa. Hindwing upperside shining dark green, darkening towards termen. Hindwing underside pale yellow; costa, termen and veins broadly lustrous grey-green; a postmedian band of lustrous grey-green between costa and vein 2, sharply defined and stepped between veins on termen side and more diffuse and arrow-shaped on basal side; between inner margin and vein 2 bright orange, except at base along cell which is pale yellow.

Measurements (mm). Forewing length mean 63 ( $n = 2$ ); antenna length mean 16 ( $n = 2$ ).

**Discussion**

As noted by Bang-Haas (1939a) in his original description, there are numerous differences between the two subspecies of *C. moeneri*. Most notable is the dark green upperside ground colour, which is essentially uniform in *C. m. mayrhoferi* and well banded in the nominate subspecies (Figs 10-13). Additionally, the dark median band on the hindwing underside is much narrower in *C. m. mayrhoferi* than in the nominate subspecies, such that the cell and discocellulars are outlined against the pale ground colour in the latter. The ground colour is cream in the nominate subspecies, yet yellow shot with orange in *C. m. mayrhoferi*. The inner margin of the hindwing underside is conspicuously orange from the base to the tornus in *C. m. mayrhoferi*, whereas orange is confined to the median area in *C. m. moeneri*. The termen is boldly black on the hindwing underside in *C. m. mayrhoferi*, whereas it is less distinct and scalloped in the nominate subspecies. *C. m. mayrhoferi* appears to exhibit some variation in the extent of the median band





**Figs 1-7.** (1-3) *Chilasa moernerii mayrhoferi*, holotype male: (1) upperside; (2) underside; (3) data labels. (4-7) *C. m. mayrhoferi*, male: (4) upperside (Baining Mts); (5) ditto, underside; (6) upperside (Whiteman Range); (7) ditto, underside. Scale bar = 20 mm.



**Figs 8-13.** (8-9) *Chilasa moeneri mayrhoferi* female: (8) upperside (Baining Mts); (9) underside. (10-13) *C. moeneri moeneri*: (10) male upperside (Schleinitz Mts); (11) ditto, underside; (12) female upperside (Schleinitz Mts); (13) ditto, underside. Scale bar = 20 mm.



on the forewing upperside and the width of the submarginal band on the forewing underside. The pale underside ground colour also appears to exhibit slight variation in intensity of the orange suffusion. Bang-Haas (1939a) described *C. m. mayrhoferi* as the 'connection' between typical *C. m. moeneri* from New Ireland and *C. toboroi* from the Solomon Islands. It is unclear whether Bang-Haas was referring to an apparent geographical or phenotypic link and neither is applicable.

Adults of *C. moeneri* behave similarly to those of related *Chilasa* species in the region (CM pers. obs.). Both sexes may occasionally be seen flying at great height above the canopy and males will sometimes establish territories in clearings or around tall trees in the rainforest. Adults have a strong, direct flight with rapid wing beats interspersed with gliding. It is possible that *C. moeneri* mimics the day-flying moth *Alcides aurora* Salvin & Godman (Uraniidae), which is also endemic to the Bismarck Archipelago. However, the latter is most common in the lowlands, where *C. moeneri* does not occur, and the moth usually flies low, close to the ground in open areas, in contrast to the adults of *C. moeneri*.

The larval food plants of *C. moeneri* are unrecorded in the literature. However, larvae of *C. m. moeneri* have been located by us on two species of *Litsea* (Lauraceae) in the Schleinitz Mountains, central New Ireland.

### Acknowledgements

Dr Marianne Horak, Australian National Insect Collection, kindly assisted in the translation of the original description of *C. m. mayrhoferi*. Professor Christoph Häuser and Dr Alexander Kroupa, Museum für Naturkunde, Leibniz Institute for Research on Evolution and Biodiversity, Berlin, Germany, kindly provided photos of the holotype of *C. m. mayrhoferi* and its label data.

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## NEW RECORDS FOR *PHYLLODES IMPERIALIS SMITHERSI* SANDS (LEPIDOPTERA: EREBIDAE) FROM SOUTHEASTERN QUEENSLAND AND NORTHEASTERN NEW SOUTH WALES

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### Abstract

New localities are provided for *Phyllodes imperialis smithersi* Sands, 2012 in southeastern Queensland and northeastern New South Wales.

### Introduction

Sands (2012) described the southern population of *Phyllodes imperialis* Druce, 1888 as subspecies *P. i. smithersi*. This subspecies is of particular interest as it is listed both federally and in New South Wales as an endangered subspecies. Sands (2012) provided distribution details based on a limited number of known specimens, a number of personal communications and some previously published papers, stating that, in Queensland, *P. i. smithersi* occurred from Kin Kin Creek, about 25 km south-east of Gympie, to the Qld-NSW border. Importantly, many exact locations were given. They were, from north to south, Blackall Range, some 50 km south of Kin Kin Creek, Witta, Conondale, Maleny, Conondale Range, Bellthorpe and Mount Mee, about 40 km north-west of Brisbane. The next localities cited in Queensland were approximately 135 km south of Mount Mee at Lamington and Springbrook near the Qld-NSW border. In New South Wales, *P. i. smithersi* is recorded from the Border Ranges, Mount Warning, Billinudgel, Richmond Range, Richmond River and, at the southern end of its range, at Dorrigo, Rosewood River, Huonville, Bellinger Island and Bellinger. These, plus the new records, give this subspecies a coastal range of about 470 km.

### New records

#### *Phyllodes imperialis smithersi* Sands, 2012 (Fig. 1)

*Material examined.* NEW SOUTH WALES: 2 ♂♂, 2 ♀♀, 3.6 km due north of Tyalgum, far NE corner of NSW, 28°19'29.45"S, 153°12'44"E, alt. 90 m, 11.iii.2012, R.B. Lachlan. Australian Museum K412769-72.

*Comments.* It appears that this subspecies may be locally common at times over the summer months but has a scattered, patchy distribution throughout its current range. This is almost certainly due to the fact that its food plant, *Carronia multisepealea* F. Muell. (Menispermaceae), is an endemic subtropical vine, largely restricted to 'old growth' subtropical rainforests on the coast and nearby ranges below 1,000 m (Sands 2012). Most records are centred around the Maleny region, south-west of Nambour, the eastern Qld-NSW border areas and at the southern end of its range around the Dorrigo-Bellinger River region. There are no published records between the Richmond River and the Dorrigo area, a distance of around 160 km.



Fig. 1. *Phyllodes imperialis smithersi*: male.

Light traps run at numerous sites on both sides of the Qld-NSW border over a period of many years, primarily during the summer months, failed to record a single sighting of *P. i. smithersi*; however, in early March 2011, a single specimen came to light at Binna Burra, 28°11'45"S, 153°11'14"E, alt. 780 m, inside the NE corner of Lamington National Park, but flew off before it could be collected. Shortly after, a Binna Burra staff member showed the author a recent photograph he took of a specimen near a light at the Binna Burra Lodge. This confirmed its presence in the immediate area.

A year later, in early March 2012, a light trap was run for three nights at 28°19'29.45"S, 153°12'44"E, close to the eastern edge of Limpinwood Nature Reserve in NE New South Wales. On one of the nights two males and two females were collected. Three of the specimens showed reasonable wear, indicating they had been on the wing for some time. It should be noted that this species rarely comes to light, even in areas where it and its food plant are locally abundant

### Acknowledgements

I am most thankful to Ted Edwards (ANIC, Canberra) for helpful comments on the manuscript. I would also like to thank Derek Smith and Russell Cox (Entomology Department, Australian Museum, Sydney) for all their assistance in the production of the digital image. Julie McInnes, Scientific Licensing Officer, Biodiversity and Wildlife Team, NSW Office of Environment and Heritage, is sincerely thanked for organising the Scientific Licence, SL 100556, under which the collection of specimens was carried out in NSW.

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## AN INLAND RANGE EXTENSION FOR *OGYRIS IDMO* (HEWITSON) (LEPIDOPTERA: LYCAENIDAE)

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### Abstract

A population of *Ogyris idmo* (Hewitson) is recorded from near Wubin, Western Australia. This record, 200 km from the west coast, represents a substantial inland range extension for what was previously considered a near-coastal species.

### Introduction

*Ogyris idmo* (Hewitson, 1862), the Large Bronze Azure, has previously been recorded from the higher rainfall coastal and near coastal areas of southwestern Western Australia, extending up to ~100 km inland at Salmon Gums (Braby 2000, Braby *et al.* 2014). Female specimens show some latitudinal variation in the upperside colouration; most specimens are purple above, although specimens from Cape Arid have the basal areas of the forewing upperside bright blue (Field 1999), while a specimen taken at Port Denison is more brightly and extensively purple than Perth specimens (Williams *et al.* 1995). The recorded flight period of the butterfly is from September to December (Braby 2000).

### Observations

Two specimens of *Ogyris idmo*, a male and a female, were collected by one of us (DMK) in the early afternoon of 29 September 2012, from a site 44 km north-east of the Western Australian wheatbelt town of Wubin. The site is alongside the Great Northern Highway at 29°49'47"S, 116°57'23"E. These specimens were in freshly emerged condition and the female (Fig. 1) is notable for being violet (*i.e.* bluish-purple) on the upper wing surface rather than the usual purple. The male is typical of *Ogyris idmo* males. The site near Wubin was visited the following day by AAEW and although a male was seen it was not caught. The following day, however, a worn female was caught by AAEW at 10.00 h, with a further female seen but not caught in the afternoon. The caught female has the typical purple colouration of most *Ogyris idmo* females.

### Discussion

Several aspects of this discovery are noteworthy. The first is that the population is much farther inland than any other population of the butterfly – roughly 200 km from the coast. Material from the specimens is currently scheduled for DNA analysis to determine if there are any genetic peculiarities associated with this isolation. Indeed, the site is at a distance from the coast where one might more reasonably expect to encounter the related Arid Bronze Azure, *Ogyris subterrestris petrina* Field, 1999. The only known

extant population of *O. s. petrina* is approximately 240 km from the coast. Michael Braby observed that 'the boundary between [the Eyrean Zone and the Southwestern Zone] is over a fairly broad region and [the Wubin site] looks like it sits within this transition zone' (M.F. Braby pers. comm.).



Fig. 1. *Ogyris idmo* female from 44 km NE of Wubin, Western Australia.

The colour variation between the two female specimens from the inland Wubin population is interesting but not entirely unexpected; one specimen is clearly violet although the worn specimen appears to be purple. Williams *et al.* (1995) referred to a female from Port Denison that is 'more brightly and extensively purple above than Perth specimens, and in this respect appears somewhat intermediate between Perth and Cape Arid (Field 1999) specimens'. The transition from purple to blue colouration between coastal and inland populations is not confined to *Ogyris idmo*. The same phenomenon is true for another lycaenid species, *Hypochrysops ignita* (Leach, 1840), where south-coastal populations are purple above while in an inland population at Watheroo National Park males are iridescent purple and females bright metallic blue (Williams *et al.* 1993, Williams *et al.* 1998).

Finally, the fact that the specimen collected by AAEW is worn, at the start of what is normally considered to be *Ogyris idmo*'s flight period (as evidenced by the two freshly emerged specimens caught by DMK), suggests that this population might represent a slight shift in the flight period of the butterfly (perhaps to as early as late August). At present, *O. idmo* is already known to fly in some locations (e.g. Port Denison) in September.



It is interesting that *Ogyris idmo* has now been located this far inland. Further investigation is required to establish whether or not it is sympatric or parapatric with *Ogyris subterrestris petrina* within the transition zone between the Eyrean and Southwestern zoogeographic regions. A recent study has also shown that *Ogyris subterrestris petrina* might also be narrowly sympatric or parapatric with *Ogyris zosine* (Braby *et al.* 2014, Braby pers. comm.).

### Acknowledgements

We thank Matthew R. Williams and Michael F. Braby for their comments on issues pertaining to this note.

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**FURTHER RECORDS OF *EUPLOEA TULLIOLUS TULLIOLUS*  
(FABRICIUS) (LEPIDOPTERA: NYMPHALIDAE: DANAINAE)  
FROM NEW SOUTH WALES AND SOUTH-EAST QUEENSLAND**

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**Abstract**

Additional distribution records from New South Wales and SE Queensland are provided for *Euploea tulliolus tulliolus* (Fabricius, 1793).

**Discussion**

*Euploea tulliolus tulliolus* (Fabricius, 1793) is thought to be common only between Cairns and Gladstone (Common and Waterhouse 1981), with few specimens collected south of Brisbane (Braby 2000, Lachlan 2014). Here, we report on specimens collected or observed at three locations in New South Wales and SE Queensland.

(1) Avalon Beach, Sydney. – An extremely worn specimen was collected from Paradise Avenue, Avalon, on 17 January 1979, 100 m from the beach front. Over a period of a decade of collecting Lepidoptera at this location, no other specimen was ever observed. However, in 1979 both *Tirumala hamata* (Macleay, 1826) and *Euploea core* (Cramer, 1780) were common. The *E. tulliolus* specimen was donated to the Australian Museum, Sydney.

(2) Coffs Harbour, New South Wales. – Six specimens were collected in 2011 and 2012, on Gaudrons Road, Sapphire Beach (a suburb of Coffs Harbour). Two perfect specimens were collected on 14 April 2011 at 0900 and 0910 h. This location borders the Orara East State Forest and they were all flying across a garden on a hill top, 100 m above sea level and 2 km from the coast. The excellent condition of all specimens suggests a breeding population might be present at this location.

(3) Mons and Yaroomba, SE Queensland. – Dozens of specimens were observed at these two Sunshine Coast suburbs (north of Brisbane), from January to May, in 2012, 2013 and 2014. The Mons locality is a suburban garden on a hill top *ca* 100 m above sea level and 5 km from the coast. The Yaroomba locality is on sand dunes *ca* 20 m from the ocean. This species appears to be common in at least these two locations on the Sunshine Coast.

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**FIRST RECORD OF THE LARVAE OF *HIPPOTION ROSETTA* (SWINHAE, 1892) (LEPIDOPTERA: SPHINGIDAE) FEEDING ON THE FOLIAGE OF *NEPENTHES* (NEPENTHACEAE) IN CAPE YORK PENINSULA, QUEENSLAND**

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**Abstract**

The larva of *Hippotion rosetta* (Swinhoe, 1892) is recorded for the first time feeding on the foliage of *Nepenthes mirabilis*, *N. tenax* and *N. rowaniana* (Nepenthaceae) in northern Cape York Peninsula, Queensland.

**Introduction**

*Hippotion rosetta* (Swinhoe, 1892) is a widespread species of hawk moth occurring from Pakistan, through SE Asia, to northeastern Australia (GBIF 2013). The Atlas of Living Australia (ALA 2013) indicates eight collections of it from Australia, all of adults, extending as far south as Townsville, Queensland. Adults feed on species of Rubiaceae and Verbenaceae, including *Lantana*, *Ixora* and *Duranta* where these occur as exotic species, but there are no previous records of its larval host plant in Australia.



**Fig. 1.** Larva of *Hippotion rosetta* (Swinhoe) feeding on *Nepenthes tenax* at Jardine Swamp, Cape York Peninsula (Photo: G.W Wilson).

## Discussion

During studies of *Nepenthes* (Nepenthaceae) in the Cape York bioregion, larvae of a lepidopteran (Fig. 1) were found feeding on the foliage of *Nepenthes mirabilis*, *N. tenax* and *N. rowaniae* at Jardine Swamp in northern Cape York Peninsula. These feeding records include all three species of *Nepenthes* now recognised from Australia (Clarke and Kruger 2005, 2006, Linnaeus 1753). A larva on *N. tenax* returned on fresh foliage to Cairns pupated, resulting in an adult moth identified as *Hippotion rosetta* (M.S. Moulds pers. comm.).

This is the first record of a sphingid species using *Nepenthes* as a larval food source. Other records of lepidopteran larvae feeding on *Nepenthes* are of *Autoba radda* (Swinhoe) (Noctuidae) on *N. rafflesiana* (Robinson *et al.* 2001), *Virachola* sp. (Lycaenidae) as seed borers of *N. ampullaria* in Borneo (Clarke 2006) and *Atrophaneura polyeuctes* (Doubleday) [as *Parides polyeuctes*] (Papilionidae) on an undetermined *Nepenthes* sp. (cited, but questioned, by Igarashi and Fukuda 1997); the last record is almost certainly an error (D.L. Hancock pers. comm.).

## Acknowledgment

We thank Dr Max Moulds for identifying *Hippotion rosetta* and providing literature references.

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# GENERIC RELATIONSHIPS OF TWO OBSCURE AUSTRALIAN THYSANOPTERA SPECIES DESCRIBED BY A.A. GIRAULT

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## Abstract

Two previously unrecognisable species of Australian thrips described by A.A. Girault are placed generically. *Giraultithrips* gen. n. is described to include *G. nigricoxa* (Girault), comb. n., originally placed in *Bagnalliella* Karny and currently included in *Haplothrips* Amyot & Serville, while *Azaleothrips perniger* (Girault), comb. n. is transferred from *Glyptothrips* Hood.

## Introduction

The prolific Hymenoptera taxonomist A.A. Girault (Fig. 1) was also author of 139 species-group names from Australia in the order Thysanoptera. Most of these were based on one or few specimens, often badly damaged in slide mounting, and the descriptions usually comprised superficial four-line notes that were published privately (Gordh *et al.* 1979). More than half of Girault's thrips species have now been synonymised (ABRS 2014) and over the past 40 years the identity and biology of most of the valid species have been established through extensive field work across Australia (Mound 2014). There have remained three names that could not be applied to any known species. *Physothrips silvae* Girault is based on a specimen of which all that remains are some unrecognisable Thripidae fragments at the edge of a cover-slip. The other two, *Bagnalliella nigricoxa* Girault and *Glyptothrips perniger* Girault, are also each based on single specimens, both of which are poorly cleared with many details not visible. They are mounted under a single, damaged cover-slip (Fig. 1), together with fragments of several other species, including the type specimen of *Elaphrothrips apterus* Girault (= *Cryptothrips badius* Hood), two specimens of *Cryptothrips cybele* Girault (= *Cryptothrips acuticornis* Hood), specimens of *Haplothrips anceps* Hood and a female that possibly represents *Microcephalothrips abdominalis* (Crawford). It is technically impractical to remount these specimens because of the risk of losing some of the fragments. The objective here is to provide an appropriate genus-level position for *nigricoxa* and *perniger*. Full nomenclatural details of all Thysanoptera are available on ThripsWiki (2014).

## *Giraultithrips* gen. n.

Type species *Bagnalliella nigricoxa* Girault, by present designation.

**Diagnosis.** Haplothripini with the head reticulate and the mesoeusternum anterior margin medially with a group of thick pale setae. Antennae 8-segmented, segment III with 1 sensorium, IV with 4 sensoria, V-VII with

pedicel parallel-sided, VIII broad at base. Head with vertex reticulate, maxillary stylets about one-third of head width apart (Fig. 2), maxillary bridge present; postocular setae capitate, longer than eye length. Pronotum transverse, with 5 pairs of capitate setae (anteromarginals sometimes shorter and pointed), notopleural sutures complete or very weakly incomplete. Mesonotal lateral setae minute; metanotum weakly reticulate, median setae slender and acute (Fig. 3). Fore tarsus of female without a tooth. Forewing weakly constricted medially, duplicated cilia absent; sub-basal setae long and capitate. Prosternal basantra well-developed, ferna abutting medially, mesopresternum broadly boat-shaped (Fig. 4); anterior margin of mesoeusternum slightly concave, with pale oval area medially bearing 4-6 stout pale setae (Figs 4-5); metathoracic sternopleural sutures absent, metasternum sometimes with several long pale setae medially. Pelta with paired campaniform sensilla; tergites II-VII with 2 pairs of sigmoid wing-retaining setae, anterior pair on each tergite weakly developed; lateral paired setae on tergites long and capitate; tergite IX setae S1 and S2 with apices bluntly pointed; tube shorter than head, anal setae shorter than tube.

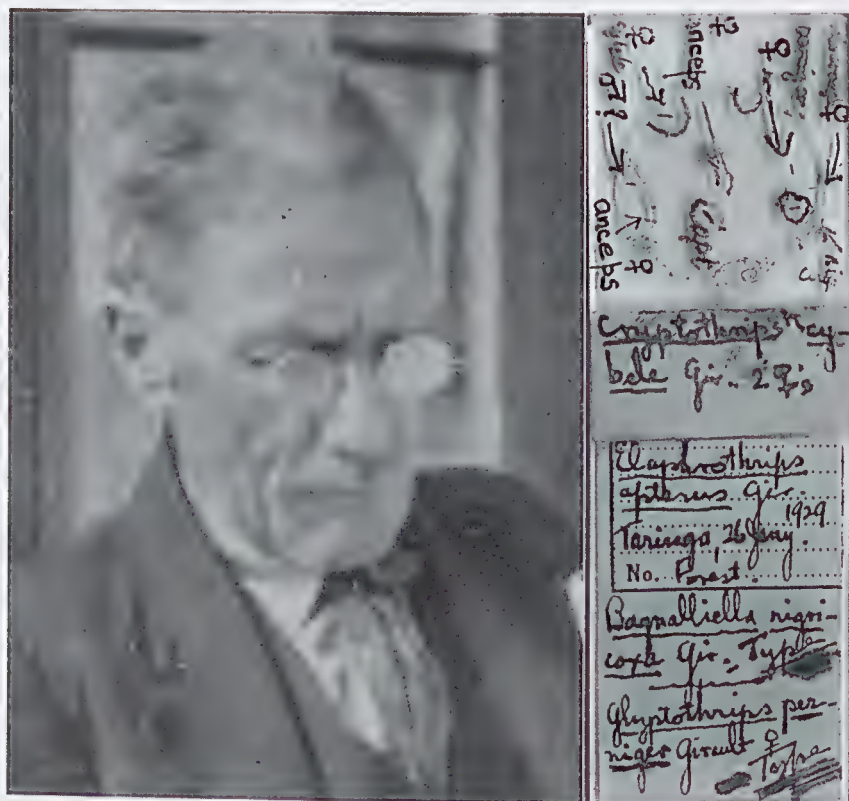
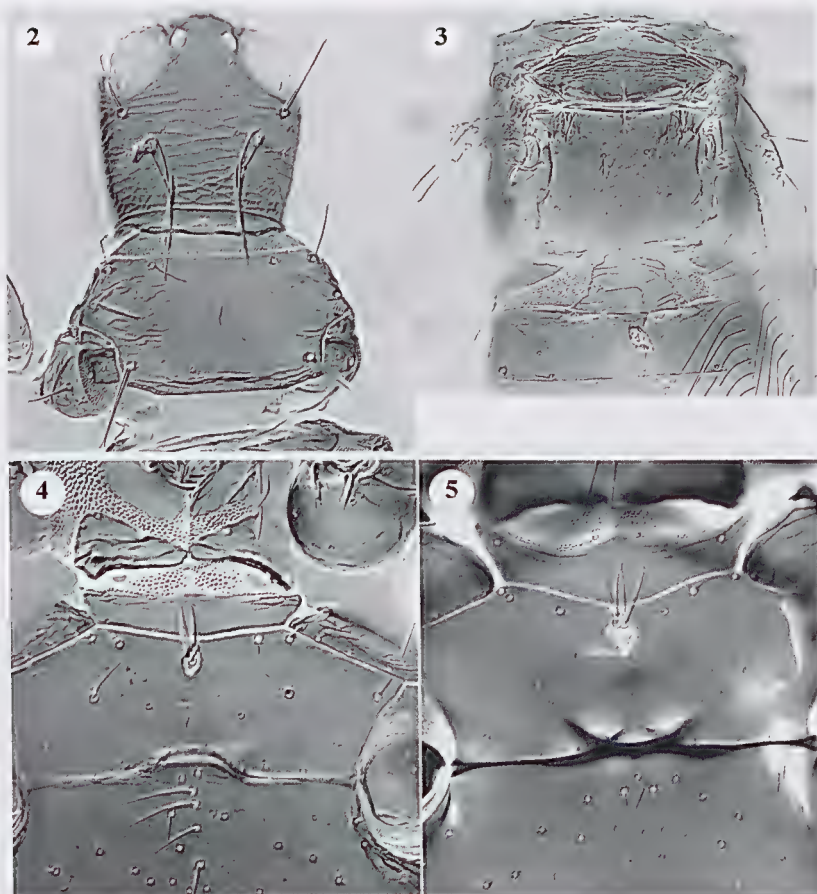


Fig. 1. A.A. Girault – the man and one of his microscope slides.





**Figs 2-5.** *Giraultithrips nigricea*: (2) head and pronotum; (3) meso and metanota and tergites I-I; (4) mesoeusternum of female from Canberra; (5) mesoeusternum of female from Lamington National Park.

**Comments.** The maxillary bridge, paired prosternal basantra and forewing median constriction all suggest that this is a member of the Haplothripini, despite the hesitation indicated by Mound and Minaei (2007). The lack of forewing duplicated cilia might suggest a relationship to *Haplothrips* (*Trybomiella*), but that group is best restricted to species with two sensoria on the third antennal segment. Moreover, the conspicuously reticulate vertex of *G. nigricea* (Fig. 2) is unlike the head of any known species worldwide in the tribe Haplothripini. The group of setae in the midline of the mesothoracic sternum is unique among Phlaeothripidae worldwide, but these setae are consistent in appearance among the available specimens.

***Giraultithrips nigricea* (Girault), comb. n.**

(Figs 2-5)

*Bagnalliella nigricea* Girault, 1929: 3.

*Haplothrips nigriceae* (Girault): Pitkin, 1973: 332.

*Material examined.* QUEENSLAND: Holotype ♀ on slide labelled: Taringa [Brisbane], Forest, 26.i.1929 [the published data stated Mt Cootha], in Queensland Museum, Brisbane (Fig. 1); 1 ♀, Brisbane, Indooroopilly, Long Pocket, from *Acacia* lvs, 26.vi.2008; 1 ♀, Lamington National Park, O'Reilly's, Moran Falls, from dead leaves, 4.viii.2013. AUSTRALIAN CAPITAL TERRITORY: 2 ♀♀, Canberra, Black Mt, from dead branch, ii.2010. NORFOLK ISLAND: 1 ♀, from dead *Elaeodendron* branches with lichen, 24.xii.2013.

This species was based on a single female but in recent years five more females have been collected. The colour and structural details of these specimens have been checked against the holotype, although that specimen is so poorly cleared that many details are difficult to discern or simply not visible. In colour, this species is light brown with the tube darkest and the legs are yellow or weakly washed with brown. Antennal segments I-III are largely yellow (brown in one specimen from Indooroopilly), with the other segments brown except for yellow pedicels on IV-V. The major setae are colourless or faintly brown. Despite the opacity of the holotype it is possible to discern the group of distinctive setae near the anterior margin of the mesoeusternum, also one long seta in the midline of the metasternum. Two females listed above from Canberra have four long stout setae in the group on the mesoeusternum and a median longitudinal row of three (or four) long and slender pale setae on the metasternum (Fig. 4). The female from Lamington National Park also has the group of four setae on the mesoeusternum but only two slender setae medially on the metasternum (Fig. 5). In contrast, the female from Norfolk Island has six stout setae in the group on the mesoeusternum but does not have any unusually long setae on the metasternum. The specimens from Lamington and Indooroopilly have the pronotal anteromarginal pair of setae shorter and pointed and the lateral abdominal setae bluntly pointed, but the female from Indooroopilly has a group of four long pale setae on the metasternum and is unusual in having the antennae almost uniformly brown except for the yellowish basal third of segment III.

The genus *Bagnalliella* Karny, in which Girault placed this species, comprises a group of Haplothripini that live on *Yucca* plants in southwestern USA. Those species all have a distinctive head with several grooves on the margins of the cheeks. In contrast, as noted above, the reticulate head of *G. nigricea* is unlike that of any known Haplothripini. Most species in this Tribe feed on floral tissues, although with a considerable number predatory (Mound and Minaei 2007), but on three occasions *G. nigricea* has been

taken from dead branches and dead leaves, suggesting that the species might be mycophagous.

### *Azaleothrips* Ananthakrishnan

This Asian genus currently includes 10 species, of which one has recently been recorded from the Cobourg Peninsula in northern Australia (Mound and Dang 2013). Moreover, a full account of this genus, increasing the number of described species to 35, has recently been published by Okajima and Masumoto (2014). Species of *Azaleothrips* have elongate maxillary stylets that are close together medially within the head and retracted to the compound eyes. The major setae on the head and thorax are very broadly expanded, often as wide as long, and the postocular setae arise almost behind the inner margins of the compound eyes. These details are visible on the holotype of the species discussed below and it is therefore transferred to this genus. The body surface of the known species of *Azaleothrips* bears distinctively delicate and complex sculpture but the surface of the *A. perniger* holotype is completely obscured.

### *Azaleothrips perniger* (Girault), comb. n.

*Glyptothrips perniger* Girault, 1929: 2.

*Material examined.* QUEENSLAND: Holotype ♀, in Queensland Museum, Brisbane. The original data were recorded by Girault as: Mt Cootha [Brisbane], forest, 26.i.1929, but on the slide bearing the holotype (Fig. 1) there are no associated data.

This species remains known only from the damaged holotype and this was probably teneral when captured. The specimen is pale brown, including all antennal segments, but there is extensive bright red internal pigment that is iridescent and obscures all surface detail of the head and thorax. The maxillary stylets are retracted to the eyes and are close together medially for the full length of the head. The postocular setae are short with the apex almost as wide as the setal length and the epimeral setae are similar in structure. The fore tarsi do not have a tooth. The forewings have no duplicated cilia and the sub-basal setae are similar to the lateral abdominal setae in having widely expanded, fringed and asymmetric, apices. The two dorsal pairs of major setae on tergite IX are slender and capitate. The only available antenna is dissociated from the body of the specimen but has segments VII and VIII fused, with no trace of a suture, and there are two sensoria on each of segments III and IV. The only known member of *Azaleothrips* with similar antennal structure is *A. moundi* Okajima, from southern Japan and Taiwan, but that has a dark brown body with the third antennal segment yellow.

Although described by Girault in *Glyptothrips* Hood, the species of that genus are found only in North and South America and all of them have the head strongly reticulate with the postocular setae wide apart (Mound 1977).



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# THE FIRST RECORDED MALES OF *SOPHIRA LIMBATA* ENDERLEIN AND *S. LIMBIPENNIS* (VAN DER WULP) (DIPTERA: TEPHRITIDAE: ACANTHONEVRINI)

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## Abstract

Males of *Sophira limbata* Enderlein and *S. limbipennis* (van der Wulp) are newly recorded from Sarawak, Malaysia and Java, Indonesia respectively. Their distinctive features and relationship with *S. appendiculata* Enderlein are noted and the specific status of *S. borneensis* Hering is confirmed.

## Introduction

The Southeast Asian fruit fly genus *Sophira* Walker was reviewed by Hardy (1958, 1980) and Hancock (2012), the latter noting that males of *S. limbata* Enderlein, 1911 and *S. limbipennis* (van der Wulp, 1899) were unknown, leading to some uncertainty over their specific status. As a consequence, the specific status of *S. borneensis* Hering, 1952 was also uncertain, it being raised from a subspecies of *S. limbata* by Hancock (2012) largely on the basis of sympatry.

Recent examination of unsorted material in the Natural History Museum, London (BMNH) revealed males attributable to both *S. limbata* and *S. limbipennis*, thereby enabling a better understanding of their identities and relationships.

## *Sophira limbata* Enderlein

*Sophira limbata* Enderlein, 1911: 435. (♀). Type locality Soekaranda, Sumatra.

*Material examined.* MALAYSIA: 1 ♀, West Malaysia, Pahang, 5.viii.1925; 1 ♂, [Sarawak, Kuching], Matang Road, 2.iv.1911, ex FMS Museum (both in BMNH).

*Comments.* The male resembles the female (see Hardy 1958) in having a narrow dark costal band that seldom crosses vein  $R_{2+3}$  except at its apex. It differs in the more diffuse dark band along vein  $Cu_1$  basally, the costal band not continuing around apex of cell  $r_{4+5}$  to unite with the dark band along vein M and in the hyaline posterior lobe to cell  $cu_1$  at the apex of vein  $A_1+Cu_2$ . This lobe is narrower and more projecting than in both *S. appendiculata* Enderlein, 1911 (see Hardy 1958) and the following species, to which *S. limbata* is evidently related.

## *Sophira limbipennis* (van der Wulp)

*Icteroptera limbipennis* van der Wulp, 1899: 213. (♀). Type locality Sukabumi, Java.

*Sophira insueta* Hering, 1952: 274. (♀). Type locality Mt Pangrango, Java. Syn. Hancock 2012: 12.

*Material examined.* INDONESIA: 1 ♂, Java, Djampang Tengah, Wangun (Mataram), iii.1938, coll. E. le Moult (in BMNH).

*Comments.* The male resembles the female (see Hering 1952) in having a broad dark costal band that reaches or just crosses vein  $R_{2+3}$  along its entire length and is not united with the dark band along vein M. It differs in the more diffuse dark band along vein  $Cu_1$  basally and in the hyaline posterior lobe to cell  $cu_1$  at the apex of vein  $A_1+Cu_2$ . This lobe is evenly rounded as in *S. appendiculata* and not as projecting and tooth-like as in *S. limbata*, providing further evidence for the specific separation of the two taxa.

### Discussion

The discovery of males attributable to *S. limbata* and *S. limbipennis* confirms the specific separation of *S. borneensis*, where males lack the posterior lobe to cell  $cu_1$  and have the genae protruding and apically 'feathered' (see Hardy 1988); this character is absent in males of the other two species.

Three species are now known where males have a posterior lobe, or 'appendix', to cell  $cu_1$ . Males of *S. appendiculata* differ significantly from those of *S. limbata* and *S. limbipennis* in wing pattern. This and the differing shape of the posterior lobe suggest that three distinct species are involved, two of which have at least partially sympatric distributions. *Sophira limbipennis* is known only from western Java; *S. appendiculata* is recorded from Sumatra (type locality) and Sarawak (Hardy 1988, who recorded a female); *S. limbata* is recorded from Sumatra (type locality), West Malaysia, Sarawak and Brunei (Chua 2000 and above specimens).

### Acknowledgement

I thank Daniel Whitmore (BMNH) for access to specimens in his care.

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# A NEW SPECIES OF *THEMARA* WALKER (DIPTERA: TEPHRITIDAE: ACANTHONEVRINI) FROM THE INDIAN ANDAMAN ISLANDS

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## Abstract

*Themara andamanensis* sp. n. is described from the Andaman Islands, India. A note on the female of *Themara hirsuta* (Perkins) is included and the species is newly recorded from Sabah, East Malaysia.

## Introduction

The genus *Themara* Walker currently contains nine species of log-breeding fruit flies that often have the male head expanded into distinctive ‘eye stalks’. The genus is widespread in Southeast Asia, being recorded from India and southern China to the Philippines, Borneo and western Indonesia. The species were reviewed and keyed by Hancock (2011), with additional notes provided by Hancock (2013, 2014). This paper describes a new species from the Andaman Islands and discusses the previously unrecorded female of *T. hirsuta* (Perkins), both resulting from a recent examination of unsorted material in the Natural History Museum, London (BMNH).

## *Themara andamanensis* sp. n.

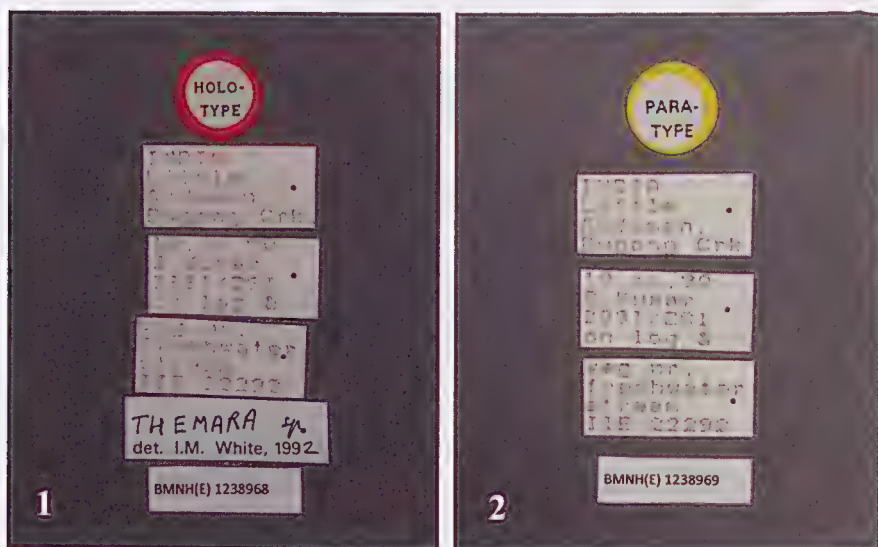
(Figs 1-5)

*Types.* Holotype ♂, INDIA (ANDAMAN ISLANDS): Little Andaman, Dugong Crk, 10.ix.[19]90, S. Kumar, on log & veg. nr freshwater stream, IIE 22292 (Fig. 1). Paratype ♀, same data as holotype (Fig. 2) (both in BMNH).

*Description.* Male (Figs 3-4). Length of body 7 mm, of wing 7.5 mm. Head much wider than long, the frons expanded laterally into ‘eye stalks’ only a little shorter than width of frons; antennae yellow, shorter than face, third segment apically rounded, arista plumose; face pale yellow, unspotted; frons yellow; occiput yellow except for a blackish brown band near upper margin. Setae black: 1 pair frontals; 2 pairs orbitals; ocellars vestigial; genal present; postoculars thin and black.

Thorax mostly fulvous to red-brown, paler on pleura, postpronotal lobes and notopleural calli; scutum with a short black stripe bordering postpronotal lobe and black dorsolateral and lateral vittae, each pair connected posteriorly; pleura with a narrow black stripe from below postpronotal lobe along dorsal margin of anepisternum to wing base. Scutellum and mediotergite fulvous with blackish brown lateral margins. Setae black: 1 postpronotal, 2 notopleurals, 1 supra-alar, 1 postalar, 1 infra-alar, dorsocentrals slightly anterior to line of postalars, presutural and prescutellar acrostichals present, 2 anepisternal, 1 weak anepimeral, 1 katepisternal; 3 pairs scutellars, the

middle pair weak. Legs dark fulvous to reddish brown, the tibiae darker; fore femora posteroventrally setose; mid tibia with an apical black spine.



**Figs 1-2.** *Themara andamanensis* sp. n., label data: (1) holotype male; (2) paratype female. [Type determination labels added subsequently]. © Natural History Museum, London.

Wing (Fig. 3) largely brown, with a broad yellow longitudinal band from wing base filling most of cells  $r_1$  and  $r_{2+3}$  except apex and costal margin; a broad yellow-brown streak in cell dm just crossing DM-Cu crossvein into cell m; base of cell  $cu_1$  broadly pale yellow-brown; cell  $r_{4+5}$  with a distinct, oval white spot just beyond line of DM-Cu crossvein and below an anteriorly directed undulation in vein  $R_{4+5}$ . Pterostigma as long as cell c; veins  $R_1$ ,  $R_{4+5}$ , M and  $Cu_1$  setose; vein  $R_{2+3}$  undulate, curving sharply towards costa but straightening at apex to meet costa at an acute angle; R-M crossvein placed below apex of pterostigma, near outer third of cell dm; cell bcu apically acute.

Abdomen oval, largely fulvous with broad black longitudinal bands anteriorly on tergites II-IV and tergite V black except fulvous posteromedially.

Female (Fig. 5). Length of body (excluding oviscapae) 7 mm, of wing 7.6 mm. Similar to male except wing vein  $R_{2+3}$  straighter, not curving sharply towards costa; tergite VI narrow, fulvous medially, black laterally; oviscapae fulvous and short, about as long as tergite V; aculeus not exposed.



**Figs 3-5.** *Themara andamanensis* sp. n.: (3) holotype male, habitus; (4) male head, dorsal view; (5) paratype female, habitus. © Natural History Museum, London.



*Etymology.* The specific name is derived from the type locality.

*Distribution.* Known only from the Andaman Islands.

*Comments.* *Themara andamanensis* sp. n. appears closest in general appearance to *T. jacobsoni* de Meijere, from Sumatra and associated islands, but differs in the shorter male eye stalks and a different wing pattern, lacking distinct hyaline anterior and posterior indentations in cells sc (pterostigma) +  $r_1$  and cells m and  $cua_1$  respectively. In *T. jacobsoni* the male eye stalks are almost as long as in *T. hirtipes* Rondani, whereas those of *T. andamanensis* are similar in length to those of *T. maculipennis* (Westwood) (see Hancock 2013, 2014). It differs from *T. yunnana* Zia, the only other species of the genus recorded from India, in the presence of male 'eye-stalks' and the very different wing pattern (see David and Ramani 2011).

### The female of *Themara hirsuta* (Perkins, 1938)

*Material examined.* EAST MALAYSIA (SABAH): 1 ♀, N. Borneo, Mt Kinabalu, Mesilau Camp, 1-5.iv.1964, 5,000 ft, Royal Soc. Exped., coll S. Kueh, BM 1964-260 (in BMNH).

The female resembles the male (*cf.* figures 3 in Perkins 1938 and 88a in Hardy 1986) but wing vein  $R_{2+3}$  is not distinctly sinuous, the hyaline indentation in cell  $r_1$  at apex of pterostigma is a broad triangle and the yellowish brown basal indentation in pterostigma extends only faintly across vein  $R_1$  into cell  $r_{2+3}$ . This Bornean species is newly recorded from Sabah, being known previously only from Sarawak.

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# TWO FURTHER NEW SPECIES OF *ABANTIADES* HERRICH-SCHÄFFER (LEPIDOPTERA: HEPIALIDAE) FROM WESTERN AUSTRALIA

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## Abstract

*Abantiades equipalpus* sp. n. and *Abantiades antenniochrus* sp. n. from Western Australia are described, illustrated and compared with other species of the genus.

## Introduction

There have been few studies on the hepialid genus *Abantiades* Herrich-Schäffer in Australia. Tindale (1932) published the last revision of the genus, naming 14 species; since then, two further Western Australian species were described by Moore and Edwards (2014). In this paper I describe two additional new species, *Abantiades equipalpus* sp. n. and *Abantiades antenniochrus* sp. n., both also from Western Australia. The terminology used for the genitalia follows Dugdale (2011), while that for wing venation follows Kristensen (1998).

## Abbreviations

ANIC – Australian National Insect Collection, Canberra, ACT; SAMA – South Australian Museum, Adelaide, SA; WAM – Western Australian Museum, Perth, WA; WADAF – Western Australian Department of Agriculture and Food, Perth, WA.

## Systematics

The genus *Abantiades* was first published by Herrich-Schäffer (1853) and the type species, *A. hyalinatus* Herrich-Schäffer, designated by Kirby (1892).

Tindale (1932) described *Abantiades* thus: ‘Antennae unipectinate often broad and lamellate in males, reduced in females. Labial palpi three-segmented, first and second segments approximately equal, apical one short, about as long as wide and subspherical, maxillary pair reduced, forming ill-articulated protuberances at base of labium. Forewings R1 separating from Rs before the branching of R5; R4 and R5 forked. Hind wings with R4 and R5 branching before the radio-median cross-vein.’

### *Abantiades equipalpus* sp. n.

(Figs 1-2, 4-14)

*Types.* Holotype ♂, WESTERN AUSTRALIA: 2 km W of S Bullabulling, 6 May 1984, E.S. Nielsen and E.D. Edwards (in ANIC). *Paratypes:* 3 ♂♂, same data as holotype (1 ♂ in SAMA; 2 ♂♂ in ANIC); 1 ♂, ‘Ribbleton’, Tambellup, 11 May 1934, H. Driver; 1 ♂, Burngup, 14 May 1934, E. Fleahy; 1 ♀, 69 miles west of Norseman, May 1968, A. Matthews (in WAM).

*Other material examined.* 1 ♀, no data (in WADAF).



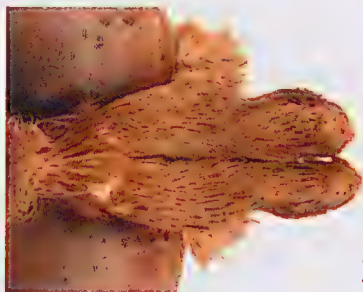
**Fig. 1.** Adult male (Holotype) of *Abantiades equipalpus* sp. n.: Upperside.

**Diagnosis.** The only known Western Australian *Abantiades* with brown hindwings and a single white line on the forewing, white in the male, off-white in the female, and the only described *Abantiades* species with the labial palps made up of equal-sized segments.

**Description.** Male (Fig. 1). Head: dark brown, densely covered in long mid brown hair scales; proboscis, none; labial palpi (Fig. 2) mid brown, three segmented, all segments of equal length, porrect; antennae (Fig. 13) with 54–56 segments, unipectinate, reddish ochre, lighter at tip, approximately one third length of costa; rami lamellate with distinct anterior projection; anterior face with distinct concave depression, densely covered in forward pointing white cilia, posterior aspect flat, thinly covered with cilia; at antennal origin rami sub-circular, 2.5–3 x filament width (fw), mid filament, circular, 3–3.5 x fw, at tip, lanceolate 1.5 x fw.



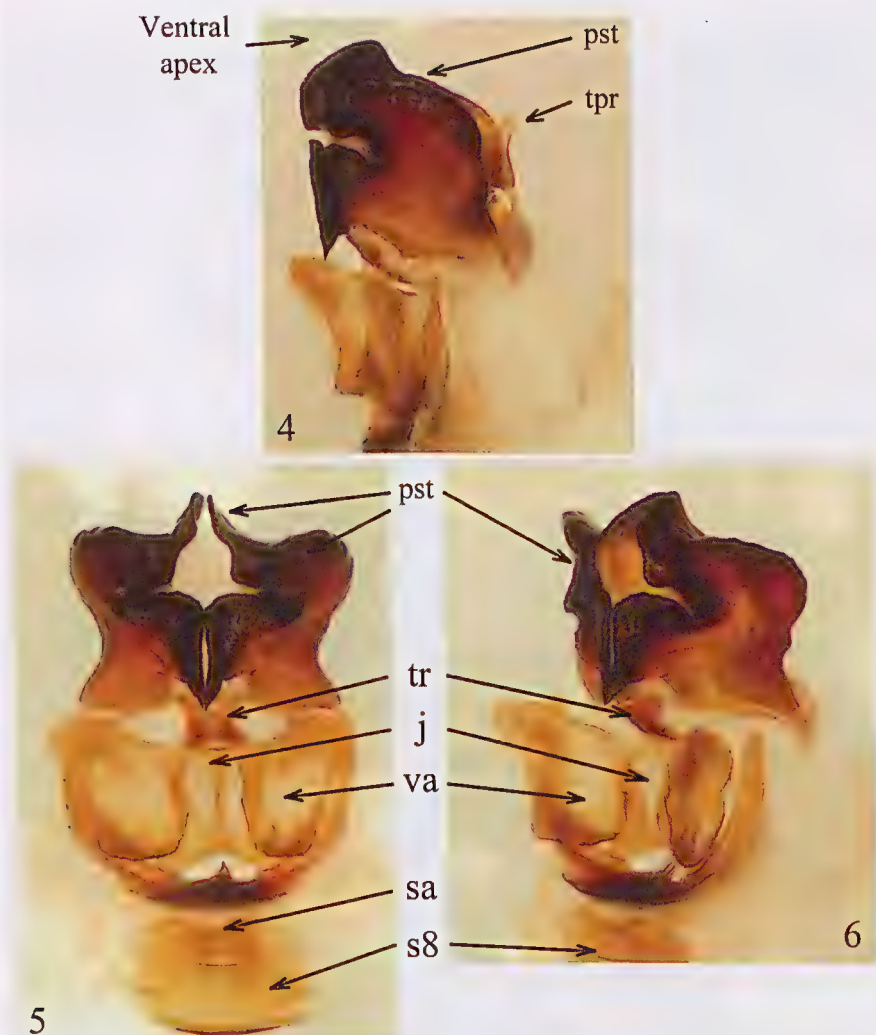
2



3

**Figs 2–3.** Labial palpi: (2) *Abantiades equipalpus* sp. n. – showing three equal labial segments; (3) *Abantiades antenniochrus* sp. n. – showing the 'normal' arrangement where the apical segment is greatly reduced.





**Figs 4-6.** Male genitalia of *Abantiades equipalpus* sp. n.: (4) lateral; (5) ventral; (6) ventro-lateral. j, juxta; pst, pseudotegumen; s8, sternite 8; sa, saccus; tpr, twin processes; tr, trulleum; va, valva.

Thorax: mid to dark brown covered in long hair-like scales; legs mid brown.

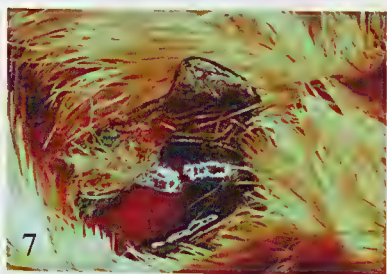
Abdomen: 25 mm; covered in long mid to dark brown hairs.

Forewing: 40-43 mm; costa straight for just over half its length then curving gently to obtuse tip; termen straight for half its length, gently and continuously curved through dorsum to wing origin. Upperside mid to dark brown; single curved white line originating at the subcostal-radial vein

divergence, then straight to the origin of M1, along M1 four-fifths distance to termen then straight to where Rs2 ends at the termen, a few white scales run from this point to the tip, line margin not entire, irregularly edged by darker brown scales, more prominent near origin; posterior half of wing covered with an indistinct scrolling effect. Underside sparsely covered in long mid brown hair scales; upper forewing markings show through forewing.

Hindwing: 32-34 mm; costa straight for two-thirds length, curving quickly, then gently to an obtuse tip; termen straight then curving gently to straight inner wing. Upperside mid to dark brown but slightly lighter than forewing; underside as for forewing.

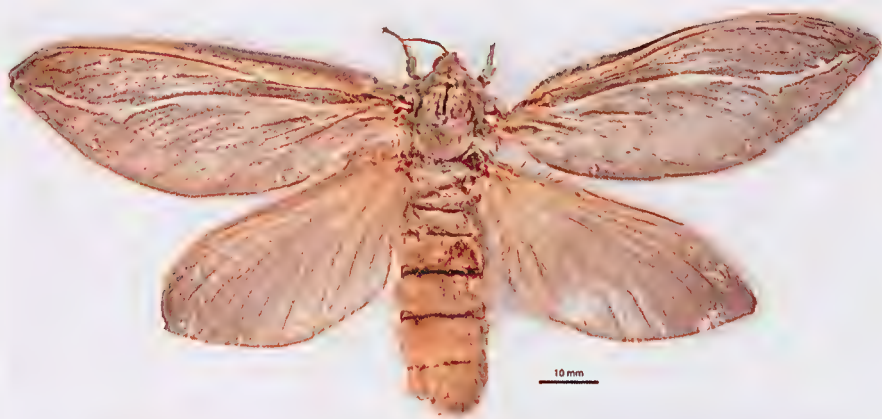
Genitalia (Figs 4-8): Pseudotegumen heavily sclerotised, ventral projection wedge shaped, tip obtuse rounded, posterior margin long, undulating, smoothly curved, anterior margin short, truncated, anterior process truncated, vertical, tip very acute; lateral processes present, ventrally projected in wide bulbous curve. Trulleum five-pointed, anterior projections lobed, ventral projections pointed; juxta large, posterior margin slightly concave, anterior margin angled; valva somewhat paddle shaped, 'handles' short and thick; vinculum with mid line heavily sclerotised, pointed; saccus deeply V-shaped; Sternite 8 with concave notch in mid-line.



**Figs 7-8.** Everted portion of pseudotegumen of *Abantiades equipalpus* sp. n.: (7) lateral; (8) anterior ventro-lateral.

Female (Fig. 9). Two females have been associated with *Abantiades equipalpus* (WAM, WADAF). Each has labial palpi with three equal-sized segments, together with the forewing markings and subtle scrolling pattern of male *A. equipalpus*.

Head: dark brown, densely covered in long yellowish to mid brown hair; proboscis absent; labial palpi (Fig. 10) mid brown, three segmented, all segments of equal length, correct, smaller and narrower than in male; antennae (Fig. 13) reddish ochre, approximately one-fifth length of costa, segmented, unipectinate; rami lamellate, face with distinct concave depression, at antennal origin 2 x filament width (fw), sub-circular, at mid filament 1.25-1.5 x fw, ellipsoid, at tip, 1 x fw, lanceolate.



**Fig. 9.** Adult female (No data, WADAF) of *Abantiades equipalpus* sp. n.: Upperside.



**Fig. 10.** Labial palpi of female *Abantiades equipalpus* sp. n.

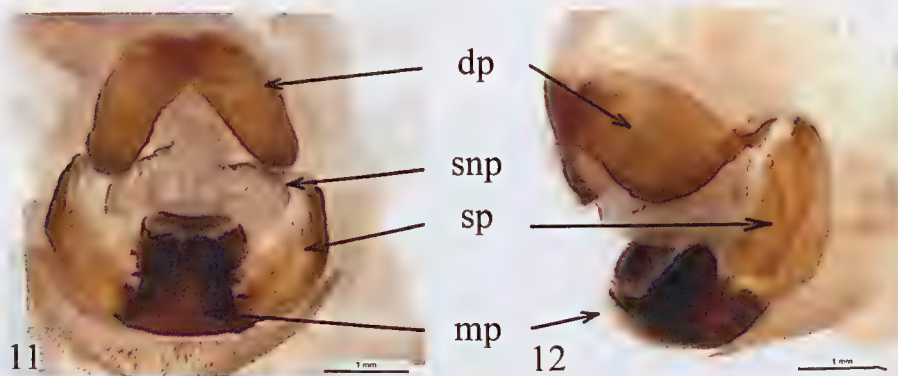
Thorax: covered in light to mid-brown long hairs; legs mid to dark brown.  
Abdomen: yellowish to dark brown, clothed in long hair.



Forewing: 55-64 mm, more lanceolate than male. General colour yellowish mid brown to dark brown, the white line present in male replaced by paler brown-white one of similar shape and position, edged in dark brown. Remainder of wing with subdued scroll pattern.

Hindwing: 45-50 mm, mid brown in colour.

Genitalia (Figs 11-12): dorsal plate moderately sclerotised, setae present at the mid point and along the open margin, distinctly three dimensional, posterior margin triangular; sternite 9 made up of the side plates, which are moderately sclerotised and roughly elliptical; median piece heavily sclerotised, distinctly three dimensional, cuboid, with two triangular projections on posterior margin, seta on posterior face.



**Figs 11-12.** Female genitalia of *Abantiades equipalpus* sp. n.: (11) ventral; (12) ventro-lateral view. dp, dorsal plate; mp, median piece; snp, subanal plates; sp, side piece. Ductus bursae and corpus bursae not shown.



**Fig. 13.** Antennal segments and rami of *Abantiades equipalpus* sp. n.: (a-c) male: (a) terminal ramus; (b) mid filament rami – side view; (c) mid filament ramus – front view. (d-e) female: (d) mid filament ramus – front view; (e) mid filament rami – side view.

**Etymology.** From *equipalpus* (Latin): pertaining to the equal lengths of the segments in the labial palpi.

**Distribution.** Southwestern Western Australia, as in Fig. 14.



Fig. 14. Collection locations of *Abantiades equipalpus* sp. n.

*Biology.* Nothing is known of the biology of this species.

*Comments.* There are two other Western Australian *Abantiades* species with which *A. equipalpus* sp. n. might be confused. Like *A. equipalpus*, both male and female *A. albofasciatus* (Swinhoe, 1892) have a well-defined single white line on the forewing; in *A. albofasciatus* the line is angled rather than curved. Males of *A. albofasciatus* have distinctly white hind wings, whereas in *A. equipalpus* the hind wings are brown. Females are more difficult to separate because the females of both species have brown hind wings. As the antennae of the females are also similar, inspection of the labial palpi is required to separate them. As can be seen in Fig. 10, *A. equipalpus* females have three equal-sized labial palpi segments, whereas in *A. albofasciatus* females the 'normal' arrangement of two equal-sized and one short apical segment holds true.

*Abantiades equipalpus* is also very similar in colouration and patterning to *A. lineacurva* Moore & Edwards, 2014, i.e. brown wings and a long dominant curving white line on the forewing. In *A. lineacurva*, however, there is always a multitude of other white markings on the forewing that make the

prominent line somewhat 'T'-shaped, whereas with *A. equipalpus* there is only the single dominant white curving line but also a subtle scroll-like pattern present that is absent in *A. lineacurva*.

***Abantiades antenniochrus* sp. n.**

(Figs 3, 15-24)

*Types.* *Holotype* ♂, WESTERN AUSTRALIA: 31.425653°S, 118.426902°E, Goldfields Rd, 400 m E of Eyre Highway, 6.5 km WSW of Burracoppin, 26 April 2014, N.B. Temby (in WAM). *Paratypes*: 3 ♂♂, 31.425653°S, 118.426902°E, Goldfields Rd, 400 m E of Eyre Highway, 6.5 km WSW of Burracoppin, 26 April 2014, N.B. Temby (in Nick Temby Collection); 1 ♂, 31.425653°S, 118.426902°E, Goldfields Rd, 400 m E of Eyre Highway, 6.5 km WSW of Burracoppin, 26 April 2014, N.B. Temby (in Fabian Douglas Collection); 1 ♂, Burngup, 8 June 1934, M. Byass and S. Taylor-Smith; 1 ♂, Pallingup River, May 1914, W.B. Alexander; 1 ♂, Cunderdin, 7 July 1913, Mrs Lundy (in WAM).

*Diagnosis.* This is the only known *Abantiades* species with dark fore and hind wings and yellow antennae.



**Fig. 15.** Adult male (Holotype) of *Abantiades antenniochrus* sp. n.: Upperside.

*Description.* Male (Fig. 15). Head: blackish, covered in long hairs; proboscis none; labial palpi (Fig. 3) three-segmented, the two basal segments approximately equal in length, apical one shorter, subspherical; antennae



(Fig. 21) with 65 segments, yellow-ochre in colour, unipectinate; rami, at antennal filament origin, obovate, 2 x filament width (fw), mid filament, broad lanceolate 2 x fw, distally, acute lanceolate to terete 1.5 x fw; all densely covered in fine whitish yellow setae, longer outward pointing setae on edges.

Thorax: covered in long blackish hairs.

Abdomen: covered in long dark greyish hairs, lighter towards thorax.

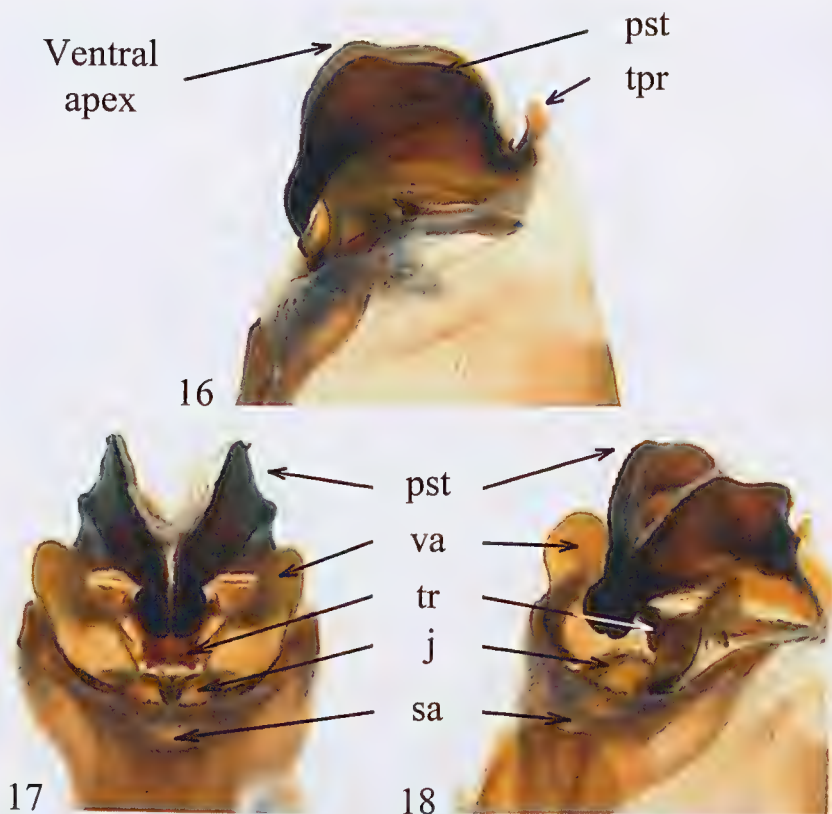
Forewing: 20-42.5 mm, median 35 mm; costa straight for just over half its length then gently continuously curved to obtuse tip, termen straight for half its length thence gently and continuously curved through dorsum to origin of wing. Upperside blackish, greyish black or brownish black with white markings, without intricate scroll-like pattern. Wing markings variable; consistently two white lines; a basal crescentic line, originating in area of darker scales at origins of M and Cu veins, runs beside M/CuA1 until following i-m cross vein, along m-r cross vein, terminating slightly posterior of Rs4; M/CuA1 retaining dark scales traverses this line minimally bisecting it; distal line originating at the end of Rs1 running obliquely to CuA1; subterminal row of 2-5 white elongate spots occupying the inter-vein spaces terminating between CuA1 and CuA2. Underside dark grey to dark brown with muted upper pattern showing through.

Hindwing: 17.5-32.5 mm, median 30 mm; costa straight for 2/3 length, curving rapidly, then gently to an obtuse tip, termen straight, curving gently to straight inner wing. Upperside dark brownish-grey, long hairs at base tending towards brown. Underside as for forewing.

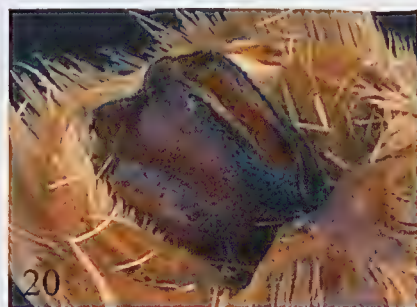
Variation. There is considerable variation in wing colour, size and patterning of the basal and distal forewing lines. General colour can vary from dark charcoal to more brownish black. Forewing basal line continuous (not bisected by dark scales), may be thicker with a more irregular margin, extra white dots or ellipses often present at ends. Distal line very variable, some with narrow almost straight white line, others a series of separated inter-vein ellipses. Number of spots in markings between the two lines varies in number (0-5) and form (points of colour to elongate dots almost forming a line). One male has subterminal spots on the hind wing.

Genitalia (Figs 16-20): Pseudotegumen heavily sclerotized, ventral projection low, curved, posterior face long, gently curved, anterior face long, steeply angled, slight lateral projection, the anterior 'beak', near vertical, distinctly knobbed; twin processes, small, set back with distinctive blunt ending; valvae, near elliptical, basal half slightly wider, distal portion covered with long setae; truellem pentagonal, anterior projections very small, posterior projections larger; juxta 2.5 x wider than high; saccus deep 'V' shaped.

Female. No females have been located in collections.



**Figs 16-18.** Male genitalia of *Abantiades antenniochrus* sp. n.: (15) lateral; (16) ventral; (17) ventro-lateral. j, juxta; pst, pseudotegumen; s8, sternite 8; sa, saccus; tpr, twin processes; tr, trulleum; va, valva.

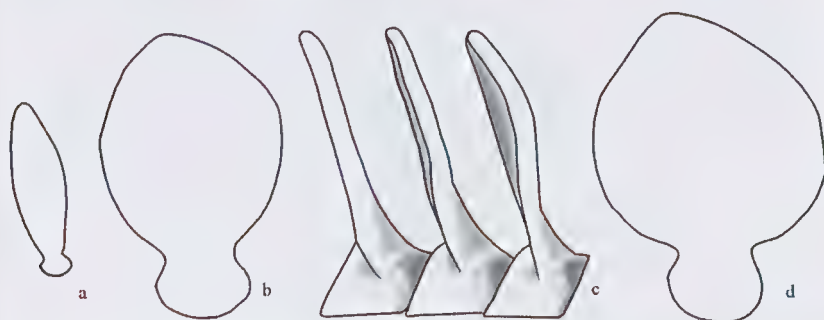


**Figs 19-20.** Everted portion of pseudotegumen of *Abantiades antenniochrus* sp. n.: (18) rear ventro-lateral; (19) anterior ventro-lateral.

**Etymology.** From *antenniochrus* (Latin): pertaining to the yellowish colour of the antennae.

**Distribution.** Southwestern Western Australia, as in Fig. 22.

**Biology.** Nothing is known of the biology of this species.



**Fig. 21.** Antennal segments and rami of *Abantiades antenniochrus*, male: (a) terminal ramus, (b) mid filament ramus – front view, (c) mid filament rami – side view, (d) basal ramus – front view.



**Fig. 22.** Collection sites of *Abantiades antenniochrus* sp. n.



*Comments.* This paper was ready to go to press when I discovered that Nick Temby had, on the 26 April 2014, collected five new specimens of *A. antenniochrus*. These fresh specimens dramatically illustrated the tendency of pigment fading in hepialids. Whereas the older specimens (Figs 23-24) were mid brown, the new ones were black, some with and others without a hint of any underlying brown even under close inspection. The specimen selected for the holotype was done on the basis that it best represented the species morphology; it also shows the greatest indication of brown undertones, possessing distinctly brown-coloured scales on the forewings and brown hairs on the hind wings. Whether this decolouration has happened since collection is unsure. In the other specimens the scales and hairs over the entire body are charcoal-black. The black is also present in the grooving between the antennal filaments, making them look darker, and on the genitalia, making them look very black indeed. In the older specimens there is no hint of this blackening, so it will be interesting to see what happens to the colour of these fresh specimens over time. Also of interest was the size variation of the specimens collected. Three matched the three older ones, with a forewing length of about 35 mm, but one was exceptionally large, with a 42.5 mm forewing, and one was extremely small, with a 20 mm forewing length.

*Abantiades antenniochrus* can be separated from all other *Abantiades* species by its colour, patterning and antennal structure. In Western Australia there are five species that can have two distinct white marks on their forewings. *Abantiades aurilegulus* Tindale, 1932 is about the same size and has two white marks but these lines appear very ragged in outline and the moths have a golden-red colouring; *A. antenniochrus* on the other hand has smoother edged lines and is blackish in colour. *Abantiades leucochiton* (Pfitzner, 1914) also has two large white markings on the forewing but the male has white hind wings and large 'plate-like' rami on the antennae, whereas *A. antenniochrus* has blacker hind wings and smaller lanceolate rami. Both *A. hydrographus* (Felder, 1868) and *A. argentangulum* Moore & Edwards, 2014 also have two white marks but their forewings are distinctly greyish and they are much larger species. In male *A. hydrographus* the white areas are thickly edged with darker scales and have distinctive tan coloured scales in and around the white areas. In male *A. argentangulum* the white areas are larger, almost silver in colour and edged darker; the distal silver/white area is distinctly triangular in shape. The distinctive spade-shaped rami can also be used to separate *A. argentangulum* from *A. antenniochrus*. *Abantiades aurilegulus*, *A. leucochiton*, *A. hydrographus* and *A. argentangulum* all have reddish to blackish coloured antennae, whereas in *A. antenniochrus* they are yellowish. Another Western Australian species, *A. fulvomarginatus* Tindale, 1932, has yellowish antennae but the rami are clothed in long setae, quite different from the small fine ones present on the rami of *A. antenniochrus*. *Abantiades fulvomarginatus* is also smaller, with the forewing covered in a pattern of greyish and whitish shapes and with no white lines present.



23



24

**Figs 23-24.** Older specimens of *Abantiades antenniochrus*: (23) Paratype: Burngup – collected 1934 (genitalia removed for imaging); (24) Paratype: Cunderdin – collected 1914. Both specimens demonstrate the loss of colour over time and the variation in the white markings.

## Discussion

Tindale's (1932) 'diagnosis' of the genus stated: 'Labial palpi three-segmented, first and second segments approximately equal, apical one short, about as long as wide and subspherical'. This is shown here not to be a valid synapomorphy for *Abantiades* as *A. equipalpus* has all segments of equal size in both sexes.

The genitalia of both male and female *Abantiades equipalpus* are also notable from a generic standpoint. The males have a pseudotegumen that is unusually wide laterally, with a dramatically truncated anterior projection that terminates in an extremely acute tip. The females have a cubic-shaped median piece which, with the highly shaped dorsal plate, holds the whole structure acutely three dimensional (Figs 11-12) even when dissected, whereas in other species the female genitalia become more two dimensional in appearance after dissection. The distinctive genitalia (from a generic standpoint) and the equal-sized labial palp segments lead one to question this species' standing within the *Abantiades* group. The fact that the veins Rs3 and Rs4 are forked seems to place it in the *Abantiades*, *Trictena*, *Bordaia*, and *Oncopera* 'group' and the overall form and structure of the moth, particularly its antennal structure, are distinctly *Abantiades*-like in nature. Knowledge about its biology and behaviour might reveal why it has evolved in the manner it has and may aid in taxonomic placement but, until this knowledge and/or genetic investigation is undertaken, it seems prudent to place it in the genus *Abantiades*.

The two species described here are the least represented in collections. Both appear to have had distributions encompassing the WA wheat belt and lack of past and present collectors and habitat alteration in these regions may certainly be factors in their apparent rarity. The recent collection of *Abantiades antenniochrus* near Burracoppin by Nick Temby is excellent news. Two of the three other known collection sites (Cunderdin and Burngup) have been largely cleared of woodland but the third location, identified imprecisely as 'Pallingup River' still has substantial woodland and collecting around here might yield more material. Collection of *Abantiades equipalpus* by Nielsen and Edwards in 1984 to the east of the wheat belt clearances suggests that populations may still be extant.

Serious collecting efforts by amateur lepidopterists and Government workers in these areas would improve our knowledge and, in turn, drive conservation strategies for these poorly known species.

This paper should strongly remind workers and students that, when working with older specimens of Australian hepialids, care is required when describing colour differences. The appearance of specimens when first caught may be brighter and more colourful or indeed seemingly different in colouring, with some colours fading or disappearing as the specimen ages.



It is the intention of Nick Temby and Fabian Douglas to distribute their paratypes of *Abantiades antenniochrus* to WAM, SAMA and the Museum of Victoria when other specimens are acquired.

### Acknowledgements

I would like to thank Ted Edwards, Peter Hudson, Chris Watts, Alexis Tindall, You Ning Su, Howard Hamon, Paul Kay, Paul Hutchinson, Nick Temby and Fabian Douglas; Ted Edwards for his intense involvement, interest and help; Peter Hudson and Chris Watts for their ongoing support and critical reading of the manuscript; Alexis Tindall (SAMA) and You Ning Su (ANIC) for their support with the imaging and computer graphics; Howard Hamon for his construction of the final images and distribution maps and for turning my pencilled diagrams of antennae into fine looking computer graphics; Paul Kay, Paul Hutchinson, Fabian Douglas and Nick Temby for their interest and support and, finally Fabian for allowing one of his specimens to be designated as the Holotype and sent on to WAM. Thanks also must be given to the staff of SAMA, WAM, WADAF and ANIC for access to specimens and equipment.

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## BOOK REVIEW

*Butterflies: identification and life history.* By R.P. Field. Museum Victoria, Melbourne, 2013, 324 pp. Softcover. ISBN 9781921833090. Price A\$29.95.

This book, recently awarded a Whitley Award Commendation for Best Regional Field Guide, is intended to be a field guide to butterflies (Lepidoptera: Papilionoidea and former Hesperioidea) in Victoria, but is more notable for its emphasis on their life histories.

It is logically organised, with sections on butterfly biology, structure, classification, natural enemies, distribution and habitats, study and conservation. These are concise but well written; the section on rearing butterflies is valuable. The identification section is arranged by family and clearly introduced. Species treatments consist of a detailed description of all life history stages, larval hosts, biology, habitat and a distribution map. Features that increase useability include specimen counts to illustrate periods of peak abundance and distribution maps that show historic changes in distribution. The colour plates make good use of space and the images are larger than in comparable guides. It is also refreshing that photos of both live and set specimens are used. The book is also comprehensive enough to be used outside Victoria. I found it relevant and more convenient than a national field guide when using in the field in southern NSW and surrounds. It should be similarly useful in Tasmania and South Australia.

While practical as a field guide, the book's major appeal is that entire life histories are figured for nearly every species, as well as larval host plants or typical habitats. The few exceptions lacked only one life history stage, or were species whose life history remains unknown. Of particular note are the automontage images of the eggs, which beautifully portray their intricate microstructures. The macrophotography of the larvae and pupae are similarly of high quality and resolution. My only criticism is that the photographs of the butterflies themselves are not as well presented as the life histories. Set specimens were photographed against a non-neutral background; some looked tired or worn, or were crooked relative to the rest of the plate. Digital manipulation or better choice of specimens could have corrected some of these issues. Photos showing posed, dead specimens as 'live' specimens are also distracting. However, these issues don't affect the book's utility.

In summary, this book distinguishes itself by setting a long overdue precedent in its treatment of butterfly life histories. As a field guide, its appeal lies in the practicality of its regional focus and relatively large image size. Future editions of this book would benefit from better photos of the butterflies themselves. It offers exceptional value and the author is to be congratulated for producing a fine work.

John Nielsen, Canberra.

**EXTREME POLYMORPHISM IN *HYPOLIMNAS BOLINA*  
(LINNAEUS) (LEPIDOPTERA: NYMPHALIDAE) FEMALES FROM  
A SINGLE LOCALITY ON THE SOUTHWESTERN CORAL COAST  
OF VITI LEVU, FIJI**

R. B. LACHLAN

*Entomology Department, Australian Museum, 6 College St, Sydney, NSW 2010*

**Abstract**

A vast array of polymorphic *Hypolimnas bolina* (Linnaeus, 1758) females were collected from two sites, just 1.1 km apart, at a single, partly forested hilly locality on the southwestern Coral Coast of Viti Levu, Fiji during December 2013 and January 2014. Their polymorphism is discussed and the majority of the specimens collected are illustrated.

**Introduction**

*Hypolimnas bolina* is a sexually dimorphic species that exhibits a striking female-limited genetic colour polymorphism (Kemp and Jones 2001). Past research has largely focused on the genetics of colour variation in this species (Clark and Sheppard 1975).

The purpose of this paper is to illustrate, more fully than previously published, the extraordinary range of polymorphism seen in *H. bolina* females and also record the fact that all these forms were collected from just one small locality in Fiji. The author has researched butterflies in numerous Pacific islands, including Papua New Guinea, since 1970 but has never seen the astonishing degree of polymorphism encountered at this single locality.

A number of authors have illustrated various forms over the years. Poulton (1924) illustrated thirty-five coloured, mostly life size, polymorphic females from Fiji. Twenty of these represented dark forms and fifteen showed various brown forms. In the Plate descriptions he also referred to a variety of form names, including *euploeoides*, *murrayi*, *nerina*, *naresi*, *montrouzieri*, *pallascens*, *thomsoni* and *elliciana*. Clark and Sheppard (1975) pointed out that a considerable number of female forms of *H. bolina* had been described and the situation complicated because essentially similar phenotypes had been given different names in different geographical areas. For clarity, they chose to use the four main forms given by Poulton (1924) to describe the four basic phenotypes and gave descriptions for three groups of intermediate female forms.

*The four basic female forms*

(i) Form *euploeoides*: ground colour dark brown, with marginal and submarginal white spots on distal border of both fore and hind wings; these white spots can be well developed or reduced; variable blue spotting from near costal border of forewing out towards the distal margin. Some specimens show variable development of the white subapical oblique forewing bar with variable amounts of blue scaling. Immaculate black or brown *euploeoides* can also be found.



(ii) Form *naresi*: ground colour very dark brown to black, with rows of white spots bordering distal edge of both fore and hind wings; forewing with subapical white bar of usually four spots sometimes tinged with blue scales. A white patch (variable in size) in centre of hind wing may have blue scaling present; brownish scaling can replace the blue on some specimens (Fig. 22). At times a small amount of brown scaling is seen near the inner margin of the forewing in a position similar to the more extensive patch found in f. *nerina*. The apex of the forewing may also show signs of this brown scaling.

(iii) Form *nerina*: very similar to f. *naresi* regarding white markings and degree of variation but differs by having a distinctive bright orange-brown patch of scales two-thirds the way along inner margin of forewing; patch size can vary considerably. When very reduced, specimens can be difficult to separate from brown *naresi*.

(iv) Form *pallescens*: white patterns similar to forms *naresi* and *nerina* in position and variability; basal areas of forewing and particularly hind wing generally dark brown, distal areas orange-brown and variable in size and colour from dark chestnut to light yellowish; the rows of dots bordering the wings are suffused with brown.

#### *The three main intermediate forms*

(i) *euploeoides-naresi*. These vary from typical *euploeoides* with an indistinct subapical oblique white bar suffused with black and blue scales, to specimens with a well-marked bar. The light area on the hind wing is very reduced and can vary from a few scales to a roundish patch shot with blue.

(ii) *euploeoides-nerina*. The white areas are again reduced and shot with blue as in *euploeoides-naresi*. However, brown scaling can be present in the pale hindwing area in some specimens and entirely brown in others. The orange forewing patch typical of *nerina* can be large or quite reduced.

(iii) *euploeoides-pallescens*. These have the general colouration and variability as *pallescens*, but differ in that the brown scaling masks the white patches on both the fore and hind wings. Therefore the insect appears brown with lighter brown areas replacing the normally white patches.

The author found that most morphs of the 107 specimens examined could be placed within these seven groups but, given some morphs contained combinations of characters from several forms, or the characters in question showed either extreme or vestigial development, placement within a form or intermediate grouping was very difficult and therefore open to question. Two morphs in particular (Figs 8 & 50) are quite unique and difficult to place with any certainty.

Clark and Sheppard (1975) also noted the polymorphism is sex-controlled in the female of *H. bolina* and surprisingly recorded the female as being monomorphic over a large part of its range. They also cited an additional rare

form from New Guinea as *pseudomisippus* and f. *kezia* from Hong Kong. They interestingly noted many forms tend to be generally restricted to certain parts of its range. The markings, colours and hues of all the different female forms indicate continuous variation that makes it virtually impossible to quantify.

Clark and Sheppard (1975) provided twenty-three coloured photographs, primarily illustrating the forms *euploeoides*, *naresi*, *nerina*, *pallescens*, *euploeoides-naresi*, *euploeoides-nerina* and *euploeoides-pallescens*. There was considerable variation amongst all the specimens illustrated as well as their localities.

Holloway and Peters (1976) illustrated four females from New Caledonia in black and white: f. *pallescens*, f. *nerina* and two additional named forms – *tracta*, a *euploeoides* form, and *pulchra*, from the Isle of Pines.

Clark *et al.* (1983) illustrated five *H. bolina* females from Fiji in black and white: forms *naresi*, *nerina*, *pallescens*, *euploeoides* and *aphrodite* (= *euploeoides-nerina*).

Corbet and Pendlebury (1992) listed many female forms found on the Malay Peninsula that additionally included *proserpina* (Cramer), *alcmene* (Cramer), *perimele* (Cramer) and *iris* Willey and went on to note that *H. bolina* had been described as the most variable butterfly in the world.

Tennent (2009), in his book on Vanuatu butterflies, illustrated twenty *H. bolina* females from various islands in Vanuatu and five from Nendo and Bellona in the Solomon Islands. Tennent (2006, 2009) reported that f. *nerina* was the more common form encountered in Vanuatu but there was an increase in the number of female forms on the southern islands of Erromango, Tanna and Futuna, particularly f. *pallescens*.

### Recent surveys

Two butterfly surveys were conducted on the Coral Coast of Viti Levu, Fiji: from 3 to 18 December 2013 and from 31 December 2013 to 21 January 2014. Relatively heavy rains had fallen for several days immediately prior to the commencement of the first survey on 3 December. *Hypolimnys bolina* females were commonly encountered at both sites, in a small patch of forest at the base of a hill and along the dirt road up the back of the same hill 1.1 km to the north-east. Many specimens were freshly emerged each day. Numerous other butterfly species were also encountered at this time at both sites and in considerable numbers. Some rain fell during the first survey. The vast majority of *H. bolina* specimens (*e.g.* Figs 1-72) were encountered and collected during the first survey. No rain of any consequence fell in late December or during the second survey in January 2014; therefore the variety of butterfly species and abundance of all species fell dramatically. Very few *H. bolina* females were collected during this period or even sighted.

Most specimens collected during the two surveys were dark forms but a small number of very light form *pallescens* were collected and also observed but were generally seen flying very rapidly, making capture impossible.

## Results

### *Hypolimnast bolina* (Linnaeus, 1758)

(Figs 1-74)

*Material examined.* First survey: 7 ♂♂, 96 ♀♀, FIJI : 6.5-7 km SE of Sigatoka, Coral Coast, Viti Levu, 18°10'46"S, 177°33'23"E, alt. 10 m and 18°10'31"S, 177°33'56"E, alt. 70 m, between 3.xii.2013-18.xii.2013, R.B. Lachlan. (All in RBL collection).

Second survey: 1 ♂, 11 ♀♀, same data except 31.xii.2013-21.i.2014. (All in RBL collection).

The various female forms encountered during both surveys and their numbers are recorded in Table 1. The single aberrant female of form *nerina* (Figs 73-74) is not included in this table because of its unique markings. Males (Figs 68, 71-72) varied only in extent of the white areas.

Due to the small number of females taken during the second survey, it is not possible to make a good comparative analysis of any differences between the two surveys other than to note that no forms of *euploeoides-pallescens* or *pallescens* were collected.

*Specimen sizes.* All measurements are set wingspans. The largest recorded were 80 mm (Figs 16 and 50); the smallest recorded was 59 mm (Fig. 51). One specimen was 60 mm (Fig. 64); four specimens (Figs 10, 24, 58) and one not illustrated had 61 mm wingspans. Approximately 21% of all females collected were noticeably smaller than average (65 mm or below), while approximately 13% were larger than average (75 mm or above).

**Table 1.** Combined results for *Hypolimnast bolina* females from both surveys.

Form	Numbers collected / %
<i>euploeoides</i>	23 / 21.7
<i>euploeoides-naresi</i>	11 / 10.4
<i>naresi</i>	18 / 17.0
<i>euploeoides-nerina</i>	23 / 21.7
<i>nerina</i>	15 / 14.0
<i>euploeoides-pallescens</i>	9 / 8.5
<i>pallescens</i>	7 / 6.6





Figs 1-3. *Hypolimnias bolina* female uppersides. *f. euplocoides*.



4



5



6

Figs 4-6. *Hypolimnast bolina* female uppersides. f. *euploeoides*.



**Figs 7-9.** *Hypolimnast bolina* female uppersides: (7-8) f. *euploeoides*, (8) with brown hindwing pattern similar to some f. *euploeoides-pallescentis*. (9) f. *euploeoides-naresi*.





Figs 10-12. *Hypolimnast bolina* female uppersides. f. *euploeoides-naresi*.



Figs 13-15. *Hypolimnas bolina* female uppersides: (13) f. *euploeoides-naresi*; (14-15) f. *naresi*.



Figs 16-18. *Hypolimnna bolina* female uppersides. f. *naresi*.





Figs 19-21. *Hypolimnast bolina* female uppersides. f. *naresi*.



**Figs 22-24.** *Hypolimnias bolina* female uppersides: (22) f. *naresi*, 'brown *naresi*'; (23-24) f. *euploeoides-nerina*.



Figs 25-27. *Hypolimnias bolina* female uppersides. f. *euploeoides-nerina*.





Figs 28-30. *Hypolimnias bolina* female uppersides. *f. euploeoides-nerina*.



Figs 31-33. *Hypolimnas bolina* female uppersides. f. *euploeoides-nerina*.



Figs 34-36. *Hypolimnias bolina* female uppersides. *f. euploeoides-nerina*.





Figs 37-39. *Hypolimnast bolina* female uppersides. *f. euploeoides-nerina*.



Figs 40-42. *Hypolimnna bolina* female uppersides. f. *nerina*.



Figs 43-45. *Hypolimnastis bolina* female uppersides. f. *nerina*.





Figs 46-48. *Hypolimnast bolina* female uppersides. f. *nerina*.



**Figs 49-51.** *Hypolimnast bolina* female uppersides: (49) f. *nerina*; (50-51) f. *euploeoides-pallescentis*.



Figs 52-54. *Hypolimnna bolina* female uppersides. f. *euploeoides-pallescent*.





Figs 55-57. *Hypolimnastis bolina* female uppersides. f. *euploeoides-pallescentis*.

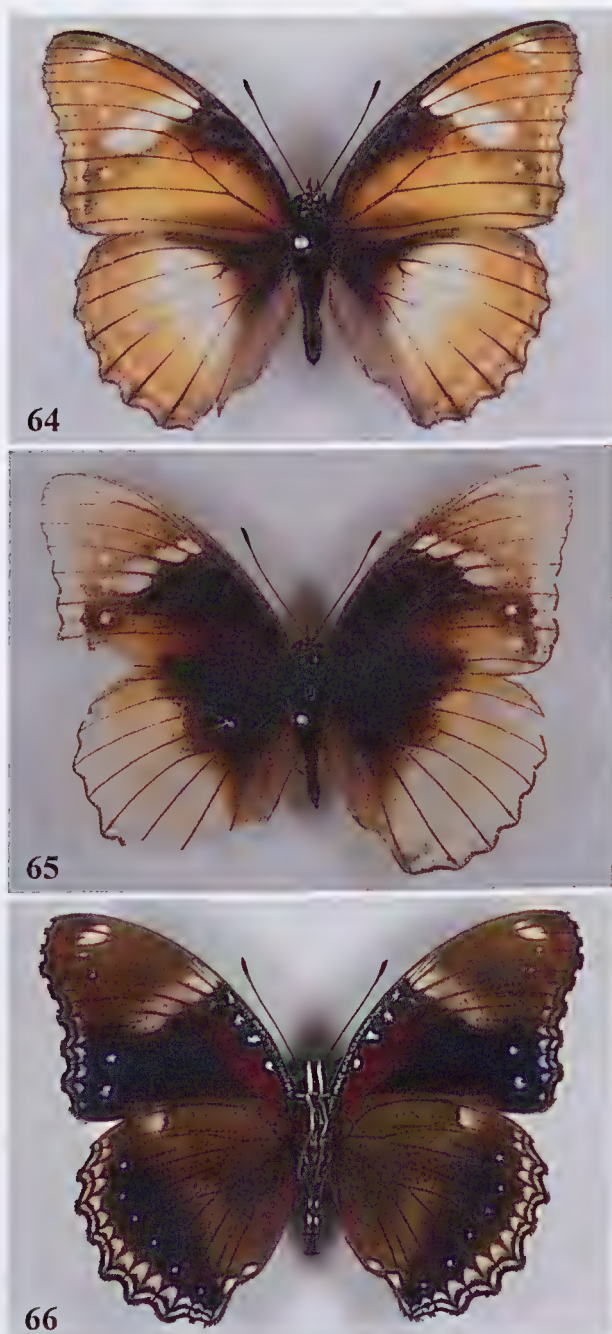


**Figs 58-60.** *Hypolimnast bolina* female uppersides: (58) *f. euploeoides-pallescens*; (59-60) *f. pallescens*.



Figs 61-63. *Hypolimnna bolina* female uppersides. f. *pallescens*.





**Figs 64-66.** *Hypolimnias bolina*: (64-65) female uppersides, f. *pallescens*; (66) male underside.



Figs 67-69. *Hypolimnast bolina* undersides: (67) female; (68) male; (69) female.



**Figs 70-72.** *Hypolimnias bolina*: (70) female underside of Fig. 3; (71) male upperside with reduced white areas; (72) male upperside with normal white areas.





**Figs 73-74.** *Hypolimnas bolina* aberrant f. *nerina* female: (73) upperside; (74) underside.

### Discussion

*Hypolimnas bolina* is recorded from the far western Indian Ocean island of Socotra (235 km NE of the Horn of Africa) and Madagascar, through Sri Lanka and India, SE Asia, China, Malaysia, the Philippines and Indonesia to Australia, New Guinea, Solomon and Vanuatu archipelagos, New Caledonia and eastwards through the Pacific islands to (on occasions) as far east as Easter Island (Tennent 2009).

Clark and Sheppard (1975) listed 126 different localities for the four basic phenotypes and two additional intermediate forms, *euploeoides-nerina* and *euploeoides-pallescentis*, of *H. bolina* females from Madagascar in the far west of its range to Easter Island in the far eastern Pacific Ocean. It is interesting to note that they only listed Guam and two other localities, Fiji and nearby Samoa, as recording all six forms.

Clark *et al.* (1983) reported that the survey of Fiji butterflies, including *H. bolina*, conducted by H.W. Simmonds between 1921 and 1931 indicated a growing scarcity of butterflies, particularly on the main island of Viti Levu. His concern was the effect man was having on the environment of the island. However, G. and B. Johnston conducted a major survey of Viti Levu in 1980 in similar areas and found *H. bolina* to be widespread and common in places. The author agrees that, despite considerable land use on the western half of Viti Levu, *H. bolina* was found to be very common at the Coral Coast locality surveyed in December 2013 and January 2014.

Phenotypic colour variation in female *H. bolina* encompasses two primary elements, variation in the tone of the overall wing surface and variation in the shape and size of discrete colour patches. Tonal variation is seen on both dorsal and ventral wing surfaces but the tone of both surfaces varies in concert. Individuals are either relatively dark or light on both wing surfaces but never dark on one surface and light on the other (Kemp and Jones 2001). The author agrees with this observation for the most part but there are rare exceptions (see Figs 3 & 70).

Kemp and Jones (2001) discussed size plasticity and noted that dry season specimens of *H. bolina* were generally larger than wet season specimens. All the specimens illustrated here are wet season butterflies but show considerable variation in size, with a forewing length between 33 and 47 mm (set wingspans between 59 and 80 mm). In fact, the author was surprised by the large size of some females clearly observed at the two survey sites.

Kemp and Jones (2001) also noted seasonal colour variation, with wet season butterflies being lighter and brighter on both wing surfaces than dry season specimens. The author, in fact, found that the majority of *H. bolina* females collected or observed at the survey sites in December 2013 were dark or darkish.

Most authors who have previously illustrated colour pictures or photographs of *H. bolina* females have shown a variety of forms but often from different localities in the one country or different countries, not necessarily in the same region of the world. In this paper all female specimens illustrated (Figs 1-65, 73), in all their forms, were collected from just two small sites only 1.1 km apart – within easy walking distance. This clearly indicates that an astonishing degree of polymorphism in *H. bolina* females is currently occurring in parts of Fiji, perhaps not seen anywhere else in its entire range.

Vane-Wright *et al.* (1977) even went so far as to suggest that the females of *H. bolina* were so variable in some areas that it was doubtful if it should be classed as a truly polymorphic species, with respect to the female, as the variation was quasi-continuous.

### Acknowledgements

I am very grateful to John Tennent (Natural History Museum, London) and Ted Edwards (ANIC, Canberra) for providing important obscure references. I would also like to thank Derek Smith and Russell Cox (Entomology Department, Australian Museum, Sydney) for their help in the production of all the digital images. I also wish to thank Meg Lloyd and David Parkhill, (Queensland Museum Library, Brisbane) for their assistance in finding and copying much needed reference material.

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## BOOK REVIEW

*Tropical fruit flies (Tephritidae: Dacinae) of South-East Asia* by R.A.I. Drew and M.C. Romig. CAB International, Wallingford, December 2013, vii + 653 pp. Hardback. ISBN 978-1-78064-035-8. Price £135 + p/p.

This comprehensive volume covers all four genera (*Bactrocera*, *Dacus*, *Ichneumonopsis* and *Monacrostichus*) and 423 known species of the tephritid fruit fly tribe Dacini recorded from East, South and Southeast Asia as far east as the northwestern part of the island of New Guinea.

In view of current (and often unfounded) speculation on the validity of some species included in the economically important *Bactrocera dorsalis* complex, this volume provides a timely and authoritative guide (with the aid of more than 400 line drawings of whole specimens) to the identity and identification of these often difficult flies. One new subgenus and 123 new species are described, while one new name and 56 new synonyms are proposed, seven species are removed from synonymy and two formerly unrecognisable species are identified and described. Tables are also provided of the pest status of species considered to be of actual or potential economic and quarantine importance.

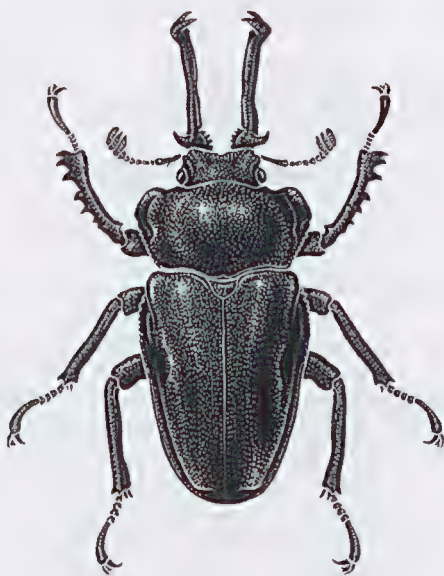
For each species, information is provided on types, diagnosis and description, geographical distribution and (where known) host plants. The *dorsalis*, *nigrotibialis*, *scutellaris* and *tau* complexes are defined and notes on the identification of cryptic species are included. For many species, host plants are still unknown and this volume provides a stimulus for further research on that aspect of the flies' biology.

Four points need to be noted: (1), the placement of several species in the African subgenera *Afrodacus*, *Gymnodacus* and *Daculus* requires further investigation; (2), the record of *Ocimum* (Lamiaceae) as a host of *Bactrocera nigrotibialis* (Perkins) and *B. hengsawadae* Drew & Romig is incorrect: these species were only swept from that plant; (3), the Sri Lankan population of *B. invadens* Drew, Tsuruta & White appears to be distinct from those found in India and Africa, which appear closer to *B. dorsalis* (Hendel); (4), the types of *B. zonata* (Saunders) are possibly represented by specimens labelled 'W' [ex Westwood Collection] in the Oxford University Museum of Natural History: these agree with the current definition of the species.

Although seemingly expensive, this book is actually very good value for the price and is an absolute necessity for anyone involved in the taxonomy, genetics, biology, pest management, quarantine surveillance or indeed any aspect of this complex yet interesting group of flies. It is highly recommended.

D.L. Hancock, Cairns.

# THE AUSTRALIAN ENTOMOLOGIST



VOLUME 41

2014

Published by:

THE ENTOMOLOGICAL SOCIETY OF QUEENSLAND

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*The Australian Entomologist* is a non-profit journal published in four parts annually by the Entomological Society of Queensland. The journal is devoted to entomology of the Australian region, including New Zealand, Papua New Guinea and islands of the south-western Pacific. Articles are accepted from amateur and professional entomologists. The journal is produced independently and subscription is not included with membership of the Society.

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ISSN 1320-6133

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**Entomologist**

Volume 41, Part 4, 1 December 2014



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